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MODEL Airplane NEWS



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ON THE COVER: senior tech editor Gerry Yarrish puts on a show for the camera during his test-flights of the Top Flite Gold Edition P-51D ARF; see his complete evaluation on page 54. (Photo by Pete Hall.) ON THIS PAGE: powered by the wind (and gravity!), this P-40 slope plane speeds by on a low pass at the 2004 Midwest Slope Challenge. Turn to page 46 to see more of these racing and combat speedsters. (Photo by Dave Garwood.)



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10 BEST WARBIRDS

If there are any modelers out there who don't love warbirds, we at *Model Airplane News* haven't met them! Big or small, these heavy-metal warriors have universal appeal. In this issue, we've collected 10 of our favorite ARF models to make it easier for you to find that perfect scale plane. How did we narrow the field? All of these planes have very high-quality construction and parts fit, exceptional scale outlines and details and great flight performance, and each is a showstopper in the air and on the flightline. Turn to page 36 to see which planes made our list—and why.

When O.S. Engines replaced its popular .46FX powerplant with the new .46AX, everyone was curious to see whether it would live up to the high standards set by its predecessor. Enter engine guru Dave Gierke, who completely tore down this new engine, reassembled it and then put it through its paces on his dynamometer. How well did the AX measure up? Turn to his review on page 98 for the lowdown on the .46AX's horsepower and rpm as well as some tidbits on nitro content and compression ratios.

Need a break from your current long-term building project? Our featured construction article this month offers nearly instant gratification! The Minimum Impact is an easy weekend build that offers topnotch performance, and it's inexpensive, too: it's built out of about a dollar's worth of blue foam sheet and is powered by two low-cost, GWS twin-motor power systems. Designed by versatile modeler Dick Sarpolus, Minimum Impact is a durable, low-cost profile model that's a blast to build and fly. We'll bet that it also inspires you to experiment with building your own sheet-foam flyers!

Most warbirds and modern aircraft have formed canopies, and scratch-building these plastic parts can be a challenging task. See how it's done in this month's "Scale

Techniques" column. Master modeler Dick van Mourik shares his techniques for vacuum-forming custom-molded pieces.

No engine, no motor; no action? Think again! Racing and combat slope sailplanes offer adrenaline-pumping, breathtaking excitement that isn't recommended for the faint of heart.

This month, photo-journalist (and "slopehead") Dave Garwood offers an inside look at one of the premier slope-racing events in the country: the Midwest Slope Challenge at Wilson Lake, KS. Check out his story and photos starting on page 46, and see these "unpowered" speed demons at their best.

Debra Cleghorn

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We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

TRI-MOTOR MAGIC

I just read the review of the electric-powered Kavan Ford Tri-Motor in your September 2004 issue. I have been looking for a model of the "Tin Goose" ever since I flew in one a few years ago at the EAA AirVenture airshow at the Wittman Regional Airport in Oshkosh, WI. Flying in the Ford Trimotor was like going back in time. It sure was noisy, though; I could have used earplugs! I would like to convert the Kavan model to the original land-based configuration and to duplicate the marking of the EAA's 1986 restoration aircraft. Do you think this would be possible? Thanks for a great magazine!

Bob Conrad
Appleton, WI

Bob, I'll bet your ride in the EAA's Ford Trimotor was memorable! I hope that you took a lot of photos so you can accurately paint the Kavan model. Considering the model's lightweight construction, I'm sure that by adding a little plywood and then using bent, 1/16-inch music wire for the gear struts, you could, indeed, convert the float-equipped Tin Goose into a land animal! A set of William Bros. vintage wheels would do the trick nicely. If your conversion is successful,



send us a few snapshots for "Pilot Projects." Good luck! GY

MORE CORSAIR

I'm an avid reader of *Model Airplane News*, and I always turn to the letters section first.

In the August issue, in the "Bent-Wing Warbird" reply, the editor attempted to explain the reason for the Corsair's inverted gull wing. It's true that the purpose of the wing design was, in part, to provide better prop clearance and shorten the landing gear's Oleo struts, but there were two other very good reasons for the inverted gull wing.

In Barrett Tillman's book "Corsair!," the author points out that the wing design was used primarily to reduce aerodynamic drag at the wing-to-fuselage juncture. (The wings meet the fuselage at a 90-degree angle.) This eliminates the need for huge wing fillets similar to those seen on the P-51s, P-47s and P-40s that were built in the same era. The other motivation behind this particular wing design was to allow the wings to be folded directly over the canopy, thereby reducing the plane's "footprint" on carrier decks. The landing gear's straight-aft retraction also permitted larger internal wing tanks. All in all, the Corsair was quite an aircraft.

Samuel L. Will [email]

Samuel, thanks for the additional information on the Corsair's unusual wing shape; you sound like quite a devotee! GY

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B-25

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RETRO INTERCEPTOR

Three cheers for Dave Robelen! I just ordered a set of plans for his modern, miniature version of Pappy deBolt's Interceptor (August 2004 issue). Considering the ever-rising popularity of electric-powered scale flyers and giant gas-burning aerobats, I was very pleased to see you publish a classic, user-friendly, 1/2A, glow-powered sport design! I am a fan of the Small Model Airplane Lovers League (SMALL) and have several Norvel BigMig-powered sport models. I really enjoy flying 1/2A models! I hope to have my Interceptor Jr. ready by the time the Dallas Radio Control Club holds its Small Steps Fly-In in September. Thanks again, and please keep us "small guys" in mind when you plan future construction articles!

Ty Wilson [email]

Ty, we always try to balance the content of Model Airplane News, and 1/2A-powered glow models are part of our recipe for appealing to all of our readers. Dave Robelen has designed and flown small RC models for a very long time, and I'm certain that you'll like what he has in store for us in the future! The Small Steps event is on September 25, and I bet the DRCC members and "Mr. Small Steps," Randy Randolph, will be pleased to see you and your Interceptor Jr. there. Have fun!

GY

TERRY'S F-100F

Love the photo of Terry Nitsch's winning F-100F Super Sabre in the August issue! I was at Top Gun this year, and Terry's jet was the most impressive one I have ever seen! Do you have any more information on this colorful aircraft, and can you tell me how he got that shiny metal finish on it?

Michael Thompson [email]

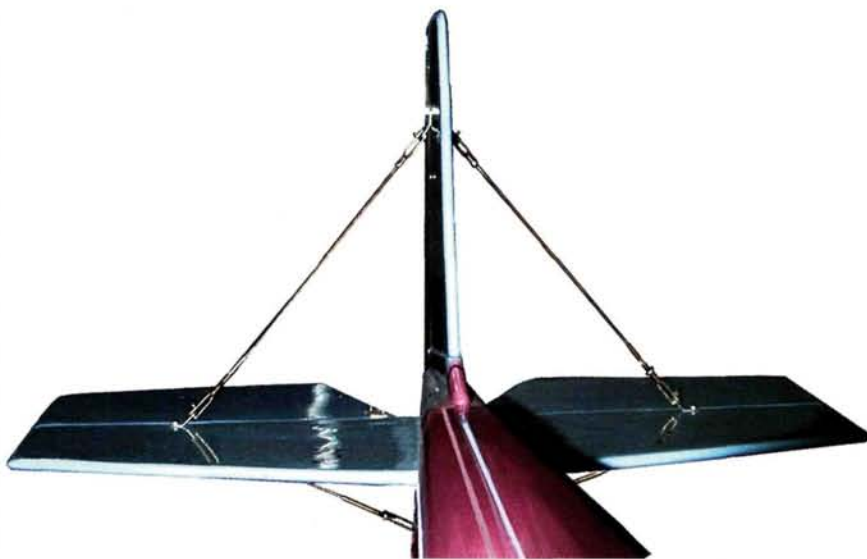
Michael, Terry Nitsch is a very talented scale competitor who has a number of Top Gun wins to his credit. His most recent aircraft is the F-100F Super Sabre you mentioned; he built it from a Bob Violett Models kit. The model has a 70-inch span and is powered by an AMT 450 turbine engine. The paint scheme is modeled after Dean Cutshall's full-size jet that has been flown at Terry's jet event, the "Heart of Ohio Jet Scramble" in Columbus.

The polished aluminum look requires lots of hand work. It's a combination of materials that begins with a supersmooth primer coat on the fiberglass surfaces followed by the application of a product called Flite-Metal (available at scaleaero.com); it's adhesive-backed aluminum foil that's applied panel by panel. The panels are then sanded with progressively finer grits of emery paper and then hand-polished for the final finish. Where paint was needed, Terry used Ditzler basecoat (aka "DBC") automotive paint and Concept clear auto paint. He burnished the rivets by hand and obtained the small screw heads and

nomenclature markings from Pro-Mark ([618] 524-2440; pro-mark.com).

Terry has remarked that the effort required to achieve these results was greater than he expected! As you've already noted, his F-100F Super Sabre is a real showstopper; he took home the High Static award in Expert as well as the Runner-up Critics' Choice award at Top Gun, and he recently won the AMA Scale National Championships, too! If you would like to learn more about Dean's full-size F-100F, check out the October 2000 issue of our sister publication, Flight Journal. GY ♣

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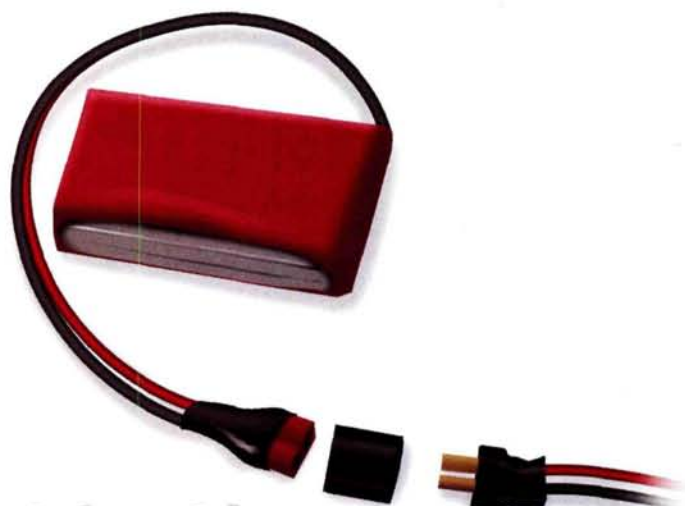
Illustrations by Richard Thompson

SEND IN YOUR IDEAS. Model Airplane News will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE THAT YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.

double duty

Sometimes you need a secure surface (other than your workbench) to support a wing or fuselage while you work on it. Plastic saw horses work nicely. Their plastic finishes won't harm the model's covering, and they can be folded up and stored easily when you're not using them. They cost about \$10 each and also come in handy when you have a home-improvement project.

Harold Nance, Lesage, WV



get a grip

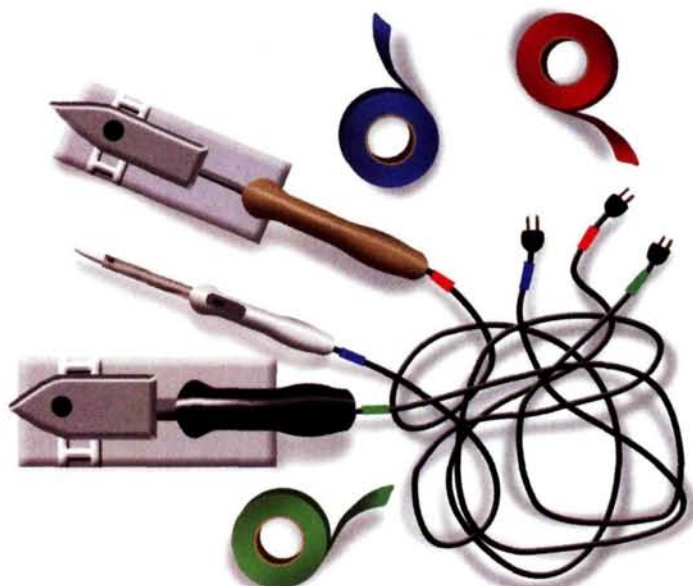
If you use Deans Ultra connectors in electric aircraft, you know that it can be difficult to get a grip on them to unplug them, especially in tight quarters such as in a fuselage. Here's an easy fix: after you've soldered on the power wires and insulated them, slip a large piece of heat-shrink tubing over the connector and shrink it into place. Use the smallest diameter heat-shrink tubing that will fit over the connector. It makes the connector much easier to grip, and the tubing doesn't add any significant weight.

Robert Hylander, Westerly, RI

easy mask

Masking the framework on a canopy can be a frustrating experience, especially if you use paper masking tape. It typically doesn't conform very well to curves, and it allows paint to bleed under it. Black electrical tape is an inexpensive alternative: it's easy to apply, has excellent adhesion and stretches enough to bend around curves. When you remove the tape, pull it back over itself, and you'll be amazed at the sharp, crisp paint line.

Ken Horrill, Nelson, New Zealand



color coded

When covering their models, many modelers use more than one iron at a time, and because their cords are identical, it's easy to unplug the wrong one, or worse, walk away thinking you had unplugged the iron you were using. To prevent this, color-code the cords with colored electrical tape. Wrap a piece of tape around the cord near the plug and another piece near the iron. When you unplug your iron, match the colors, and you'll be sure to have the correct iron cooling off.

Leslie Bradshaw, Hartsville, SC

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable, but please do not send digital printouts or Polaroid prints. Emailed submissions must be at least 300dpi. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of \$500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.



Mirage

Tony J. Kameen, Moreno Valley, CA

Originally built by Burt Ayers, this Mirage was created from a Jet Hangar Hobbies semi-kit in 1981. Tony bought the model at a swap meet after it had traveled from the U.S. to England and back again; it has even appeared in commercials. Because of the Mirage's extensive travel and constant handling, Tony needed to re-skin a wing, strip all of the glossy gray paint off its surface and redo the cockpit. The improved cockpit features a strobe light, a radar sweep display and retracts. The Mirage is powered by an O.S. .46VX DF engine and controlled by an Airtronics Spectra 7 PCM radio, and it has Rhom Air retracts. Tony finished it with Model Master enamels, Perfect Poly-U flat clear and homemade decals to give it the colors of a VF 43. Keep visiting those swap meets, Tony—what a terrific find!

Sopwith Camel 1F1

Robert Pitzer

Hallandale Beach, FL

Robert's model was inspired by a 1917 scale drawing of a Sopwith Camel by William Wylan. This very detailed model features carefully scratch-built parts that include a cockpit, cowl, machine guns, propeller, dummy engine, pitot tubes, Aldis gunsight and wheels. He used ring seals for the wheels and piano wire for the model's rigging. When you consider the size of this model, the details are very impressive. The Sopwith's wingspan is only 13½ inches. Wonderful craftsmanship, Robert.



RV-4

Monte Cardwell

Wabash, IN

Using only three photographs of a full-size RV-4, Monte created a ¼-scale model! His RV-4 is powered by an O.S. .40 engine, and he controls it with a Hitec Eclipse 7 radio and servos. The RV-4 weighs only 6 pounds, and Monte boasts, "It flies great!" Fantastic re-creation, Monte!



L-4B

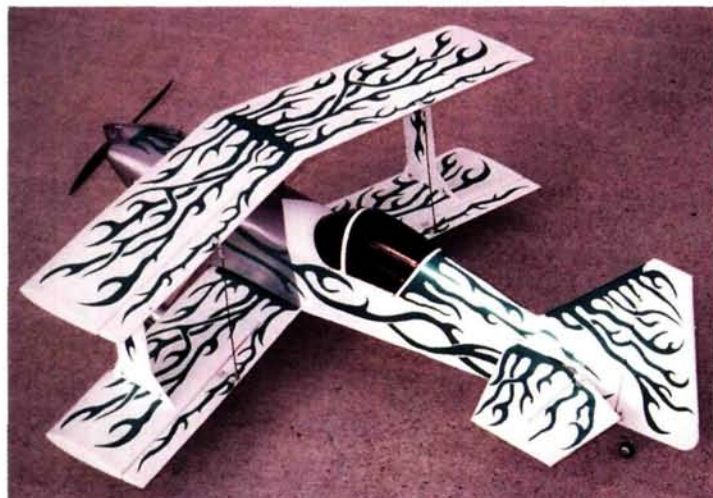
Ken Hodges

Newton, NC

Over the course of 8 months, Ken modified a Sig 1/8-scale J-3 Cub into an L-4B military plane. He powers his model with a Saito 4-stroke engine and an onboard glow system for reliable low idle speeds. Ken completely scratch-built



the dummy engine and spark plugs out of balsa, cardboard tubing and wires. The scale main gear is from Wm. Wallace, and according to Ken, "... [the gear] has real bungee action." The plane is covered with Sig Koverall and dope and painted with deep forest-green acrylic. Ken used Top Flite's LustreKote Dove Gray paint under the wing and on the horizontal stab, the fuselage and the interior. The numbers and stars are custom-made vinyl adhesives. Last, he sprayed his model with satin polyurethane for a dull finish; but Ken, your plane is anything but dull. Great job!



Beechcraft G-17S Staggerwing

Normand Desrosiers

Lynn, MA

This scratch-built Staggerwing from Novacks Vintage R/C Plans has a 64-inch wingspan and Spring Air retracts, and it's powered by a YS .90 4-stroke engine. Normand used eye-catching Missile Red MonoKote to cover the plane, and LustreKote gives the Beechcraft its shiny finish. He made the wings removable with upper and lower wire bracings. Nice-looking bird, Normand!



Ultimate 40 ARF

Ron Williams

Calgary, Alberta, Canada

As you can see, Ron has turned this Dave Patrick Ultimate into quite a masterpiece. It took one week and an entire roll of Pearl Green UltraCote covering for Ron and his son, William, to design and cut out the Ultimate's trim. An O.S. .50 SX engine powers this beauty, and they use a Futaba 9C radio. Ron tells us that "... it's a little over-powered, but it flies well." Great teamwork, guys.



Cap 231 EX ARF

Item #SIGRC77ARF
Wingspan - 73 in.
Wing Area - 962.5 sq. in.
Flying Weight - 10.5 - 11 lbs.
Recommended Engines:
1.20 - 1.50 2-Stroke
1.20 - 1.80 4-Stroke

Extra 300XS ARF

Item #SIGRC78ARF
Wingspan - 73-5/8 in.
Wing Area - 990 sq. in.
Flying Weight - 12 - 13 lbs.
Recommended Engines:
1.20 - 1.50 2-Stroke
1.20 - 1.80 4-Stroke



Sukhoi SU-31 ARF

Item #SIGRC81ARF
Wingspan - 76 in.
Wing Area - 1152 sq. in.
Flying Weight - 13 - 14 lbs.
Recommended Engines:
1.50 - 2.10 2-Stroke
1.80 - 2.7 4-Stroke
2.4 c.i. gas engine



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Taylorcraft Model B

Vernon Coop

Joliet, IL

In just 6 months, Vernon designed and built his Taylorcraft primarily out of materials purchased from a home-improvement store. This massive model stands 35 inches high, is 130 inches long, has a 170-inch wingspan and weighs 80 pounds. He powers his model with a 3W 150 17hp engine. Vernon built the fuselage out of $\frac{1}{2} \times \frac{3}{4}$ pine trim and used a D-tube wing design. He built the cowl out of aluminum and fiberglass with left- and right-hinged doors, and he finished his plane with Stits covering. We hope it flies as good as it looks!

Ju-88 C-6 Fighter

Ty Brown, Kannapolis, NC

Ty built this $\frac{1}{6}$ -scale Ju-88 from scratch! With a wingspan of 126 inches, the Ju-88 needs two G-38 Zenoah gas engines and 3-blade propellers to hoist the model's 45 pounds into the sky. Ty also used Robart rotating retracts with eight functional gear doors. To get that authentic look, he used Testors Model Master Flat White for the finish. Ty explains, "The color scheme is winter camo, and the plane has a fake greenhouse painted on the front to hide the cannon and to lure the Russians into head-on attacks." Great details! ✈



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	COVQ0243 Microlite Silver
	COVQ0244 Microlite Cream
	COVQ0245 Microlite Black
	COVQ0246 Microlite Dark Blue
	COVQ0247 Microlite Yellow
	COVQ0248 Microlite Red
	COVQ0249 Microlite Transparent Yellow
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	COVQ0251 Microlite Transparent Blue
	COVQ0252 Microlite Transparent Green

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*Microlite is not fuelproof, should not be used on foam surfaces, and cannot be painted.

by the Model Airplane News crew

WATTAGE

AT-6 TEXAN 400

With realistic details like air scoops, hand-drawn panel lines, factory-painted dummy-engine cylinders, a steerable tailwheel and a "bird cage" canopy, this park flyer is sure to please even the most demanding scale pilots! This full-house ARF model features a molded, factory-painted fuselage and cowl, and it comes with micro adjustable hardware and a detailed, photo-illustrated instruction manual. Just add a 4-channel RC system and WattAge Super 400 Cobalt motor (not included), and you'll be ready for action. Specs: wingspan—36.5 in.; wing area—188 sq. in.; length—25.5 in.; weight—19 to 25 oz. The best part? A price tag of only \$89.99. You'd better put your order in now; these beauties are sure to go fast!

WattAge; distributed by Global Hobby Distributors (714) 693-0329; globalhobby.com.



FLYING STYRO

P-38 Lightning

This beautifully detailed ARF park flyer comes with a painted, hollow-molded foam fuselage and numerous vacuum-formed plastic detail parts, wheels, landing-gear struts, gear doors, drop tanks, air scoops, radiators—even mass balances on the elevator! It also features a detailed cockpit interior—right down to the gunsights. A 14-page, photo-illustrated manual guides you through every step of assembly. With the recommended Axi 2208/34 brushless motors, flight performance is very good. Specs: wingspan—43¾ in.; length—30 in.; wing area—243 sq. in.; weight—24 oz.; radio req'd—3-channel with 3 servos. The Flying Styro P-38 costs \$199.

Flying Styro; distributed by Hobby Lobby Intl. (615) 373-1444; hobby-lobby.com.



EVOLUTION ENGINES

1.00NX

Anyone can make a big-bore 1.00 engine with lots of power, but leave it to the engineers at Evolution to make one that's simple to tune and a cinch to start. Because it shares the same footprint as a .91, you can apply its hassle-free operation and incredible power to almost any .60 to .91 airplane and enjoy spine-tingling vertical performance. Specs: displacement—1.00ci; bore—1.140 in.; stroke—0.985 in.; weight—23.2 oz.; rpm—1,950 to 10,780 (with APC 14x6 prop). The Evolution 1.00NX costs \$169.99.

Evolution Engines; distributed by Horizon Hobby Inc. (217) 352-1913; horizonhobby.com.



AUTOGYRO CO. OF ARIZONA

GYROBEE/LAZY BEE ARF

Autogyro Co. of Arizona's first ARF autogyro kit features the fixed-wing Lazy Bee and the autogyro GyroBee in one box, so you can easily switch between aircraft types. Flown in the autogyro configuration, the GyroBee design is so stable and forgiving that it's an ideal autogyro trainer. At the field, removing the wing from the Lazy Bee and replacing it with the GyroBee conversion module takes only a few minutes and doesn't require any balance changes to the airframe, trim adjustments, or radio modifications! It uses any simple 4-channel radio (no mixing required) and any powerplant/prop combination that produces at least 3 pounds of static thrust (a .30 to .40 4-stroke, .25 2-stroke or brushless electric are recommended). This convertible plane is especially well-suited to small field operation. The kit includes a fully built and covered fuselage, a wing, balanced rotor blades, a rotor pylon, two types of landing gear, a rotor bearing assembly, an elastomeric flapping head plate, two assembly/flying manuals, a laser-plotted plan sheet, wheels and all other finishing hardware. The complete GyroBee/Lazy Bee ARF combo is \$325.

Autogyro Co. of Arizona (623) 582-9428; autogyro-rc.com.





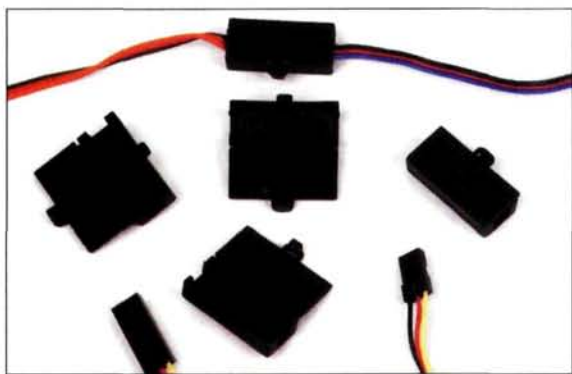
KONTRONIK TANGO & TWIST

For power and longevity, brushless motors are the way to go, and now Kontronik adds two new brushless lines to its extensive lineup. The Tango motors are the largest, and they are designed for extremely high power, precision and efficiency, so they're ideal for use in large airplanes and helis. Each motor features a steel can with a built-in cooling fan and offers a very high power-to-weight ratio. The 10.6-ounce Tango is 2 inches long and 1.77 inches in diameter with a 0.20-inch-diameter shaft.

The new Twist brushless motors have built-in cooling fins on an aluminum can to minimize weight and distribute heat better. They are designed to be a drop-in replacement for 480 and 550 brushed motors and are well-suited to small and medium electric helis.

Both lines feature hardened-steel output shafts and large Powerdym magnets. The Tango motors cost \$259.99 each; the Twist motors are \$179.99.

Kontronik; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; greatplanes.com.



SLIMLINE PRODUCTS SNAPLOCK SAFETY CONNECTOR

Back when all servos were mounted in the fuselage next to the receiver, there was very little need for servo-extension plugs. But now, with the availability of larger planes and the popularity of mounting servos close to the control surfaces, servo extensions are now more commonly used. With them comes the risk of the plugs separating during flight. Slimline's new Snaplock Safety Connectors prevent that from happening because they securely and easily snap over servos' extension plugs and lock them together. When you remove the servo, you can release the Snaplock with your fingers. You can't beat their simplicity and security and the peace of mind they offer. Six Snaplock Safety Connectors come in each \$4.99 pack.

Slimline Products (480) 967-5053; slimlineproducts.com.



MODEL TECH

DELTA FIGHTER 90

It's hard to find a plane that offers more lift, stability and all-out speed than a delta wing—especially one that's powered by a .90 engine! The Delta Fighter 90 has a painted fiberglass cowl, laser-cut wood construction, Top Flite MonoKote covering and a complete hardware package. A molded canopy, steerable nosewheel and detailed instruction manual round out its impressive list of features. And because it's from Model Tech, you're assured of its high-quality construction and materials. In the air, this Delta can reach blistering speeds, and because its bottom is covered in a different color from its top, in-flight orientation is easy. Specs: wingspan—54 $\frac{3}{8}$ in.; wing area—1,287 sq. in.; length—43.25 in.; weight—7.25 to 7.75 lb.; wing loading—13 to 14 oz./sq. ft.; engine req'd—.60 to .91 2-stroke. The Delta Fighter 90 costs just \$199.99.

Model Tech; distributed exclusively by Global Hobby Distributors (714) 963-0329; globalhobby.com.

MODEL AIRPLANE ENGINEERING

Nemesis 3D-II

With a fully symmetrical 27-inch wingspan, this small 4-channel plane is a capable 3D flyer at both outdoor and indoor venues. The kit consists of interlocking laser-cut balsa and ply with a carbon-fiber tube "backbone" for structural integrity. Full-size CAD plans and a photo-illustrated instruction manual are included. Power options vary from inexpensive small brushed motors to efficient brushless outrunners. If you use a Li-poly battery and light RC equipment, you can achieve an impressive all-up weight of 4.5 to 6.5 ounces. The Nemesis 3D-II is also a well-mannered sport aerobat and is designed to withstand the occasional mishap. A landing-gear option is also available. The kit costs only \$43.95.

Model Airplane Engineering
(770) 925-8326; M-A-E.com.



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Glow drivers are only as good as the batteries that power them, but this unique unit features lithium-ion power for outstanding longevity and unprecedented starting reliability. The RCAT Li-ion glow starter will automatically adjust the current to your fouled plug for trouble-free starts every time. With all the planes we test-fly for the magazine, we can't wait to get our hands on this one!

RCAT Systems (408) 292-9794; rcatsystems.com.



ULTRAFLY

ARF FOAM ELECTRICS

Hot-flying 3D foamies are the hottest ticket in RC, and this brand-new line from the topnotch engineers at Great Planes may just set a new standard. Not only do these lightweight, easy-to-assemble foamies offer great scale looks, but they're also fantastic performers in the air. Instead of designing the plane first and then trying to find a motor for it, Ultrafly developed the power system and then created a perfectly suited airplane design. Each plane's Speed 400 motor has small-diameter windings that allow it to handle high voltages and amps (read: more power and more capacity!). The included gearbox comes with four spur gears and brass pinions, so you also have a large range of gear ratios. The Cessna comes with two 43-inch-span wings: one for docile, trainer-like flight and the other for aerobatics. The low-wing, 28-inch-span PC9-400 is stable at low speeds but also capable of thrilling aerial maneuvers. The 32-inch-span BAE Hawk is a pusher-prop jet for those who have a need for all-out speed. The dense, smooth-surface foam material is extremely light and can be painted.

The Cessna 182 costs \$84.99; the PC9-400 and Fly BA-E Hawk each cost \$79.99.

Ultrafly; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; greatplanes.com.



RWDR

CHIPMUNK

Designed around an Axi 2820-10 motor, this Ron Daniels model is fully aerobatic and has a symmetrical wing. In the air, it performs smooth, pattern-like aerobatics and stunning snaps and spins. It's also equally comfortable doing inside and outside maneuvers. The 45-inch-span model has 340 square inches of wing area and weighs just 42 ounces with 10, 1700CP cells. The all-wood kit comes with both a stock and an "Art Scholl" vertical tail. A unique fuselage jig makes it easy to build the scale fuselage. The kit costs \$106.99 plus S&H.

RWDR (519) 743-5549; rwdr.com.



DU-BRO

HEAVY DUTY, MONSTER AND DUAL SWIVEL BALL LINKS

The new Heavy Duty ball links are designed for larger planes that require a stronger pushrod connection. These high-quality ball links provide a strong positive connection and feature burnished brass swivel ball for smooth operation. The Monster ball links feature the same high-quality construction but are beefier, tougher and more durable—perfect for the pushrod connections that are subjected to the most stress. The Dual Swivel ball links (available in 2-56 and 4-40) are perfect for rudder/tailwheel, rudder/nosewheel, single servo aileron hookup, or any other dual-directional pushrod connection. 6-32 Heavy Duty ball links—2/pkg.; \$4.25, 12/pkg.; \$33. 6-32 Monster Ball Links—2/pkg.; \$5.50, 12/pkg.; \$33. Dual Swivel ball links—(2-56) 2/pkg.; \$4.95, (4-40) 2/pkg.; \$4.95.

Du-Bro Products (800) 848-9411; dubro.com.

SEAGULL MODELS

LASER 200

This 1.20-size ARF aerobat offers big-ticket performance without the big price tag. Built out of top-quality balsa and ply and covered with Hangar 9 Ultracote, the Laser 200 1.20 costs just \$235—less than just about every 3D machine in its class! In the air, the Laser will thrill with its high-energy, 3D capabilities that are comparable with anything else in the sky. Snap rolls, point rolls, spins, knife-edge—it does them all with a feeling of precision that inspires confidence and lets you push the envelope. Specs: wingspan—68.75 in.; wing area—735.6 sq. in.; length—63.4 in.; weight—10 to 12 lb.

Seagull Models; distributed by Horizon Hobby Inc. (217) 352-1913; horizonhobby.com. ✦



TOP 10

SCALE

by the Model Airplane News crew



GIANTSCALEPLANES.COM

F6F Hellcat ARF

Yeah, we know: just about every other successful WW II fighter was sleeker and sexier than the Hellcat. In terms of what a fighter could contribute to victory, however, the Hellcat is the uncontested king of the Pacific. It would seem that Giantscaleplanes.com used the same design philosophy as Grumman did for the original plane: simplicity in design and assembly with aerodynamic stability. The F6F Hellcat features a fiberglass fuselage, cowl and belly pan. The built-up wings are sheeted in Solartex covering, as are the tail feathers.

This plane is a pleasure to fly; takeoffs and landings are practically effortless. Just advance the throttle, add a bit of right rudder to maintain heading, and the plane is in the air before you know it. It handles low and high speeds with ease, and if you're in the mood for aerobatics, you definitely have the right plane here. This capable plane has ample power for just about any scale maneuver.

COMBAT-READY SPECS

	Model	Full-size
Wingspan	70 in.	42 ft. 10 in.
Length	53.5 in.	33 ft. 4 in.
Weight	10.5 lb.	9,042 lb.
Power	.91 2-stroke	Pratt & Whitney R-2800-10 Double Wasp 18-cylinder
Price	\$350	\$1,600,000

We particularly like ...

- Beautiful scale appearance.
- High-quality components.
- Outstanding flight performance.

Flight performance ★★★★★
Cool factor ★★★
Scale appearance ★★★★★

Inside every red-blooded RC modeler lurks the soul of a fighter pilot (of the Walter Mitty variety, that is!). From our very first afternoon with a trainer, we long to become aces and to fly RC Mustangs, Spitfires and P-40s. Until recently, the road to war wings was a fairly long one that required experience with a variety of models to hone our building and flying skills; fortunately, however, modern almost-ready-to-fly (ARF) warbirds have greatly reduced the mission profile. Today's ARFs are very easy to assemble, and because of their lighter wing loadings (compared with those of older, kit-built models), they're much easier to fly successfully! It is not at all unusual for a modeler's third or fourth airplane to be a warbird. We've collected 10 of our favorites here; check them out!

★★★★★ = Superior
 ★★★★ = Excellent
 ★★★ = Good
 ★★ = Fair
 ★ = Poor

WARBIRD ARFS

"I haven't flown very many scale planes that performed this well, so flying the Me-109 was a pleasant surprise."



GWS Me-109 ARF

Produced in abundance during WW II, the Me-109 (also known as the BF-109) was the German Luftwaffe's workhorse. This versatile plane did everything asked of it by the German high command. GWS faithfully reproduces the look and feel of this majestic plane in its Me-109 ARF kit. This polystyrene-foam-construction plane offers many scale detail features, including panel lines, an air-intake vent and motor exhaust. With the exception of the prop and wheels, this is a nicely scaled backyard flyer. It comes painted with a gray base coat and is ready for you to add your favorite camouflage color scheme.

This small, light, park flyer can be flown in just about any open field, and it is also a very capable aerobatic performer. It flies quite well and is very stable, but it's definitely designed for advanced pilots who are quick on the sticks with corrective input.

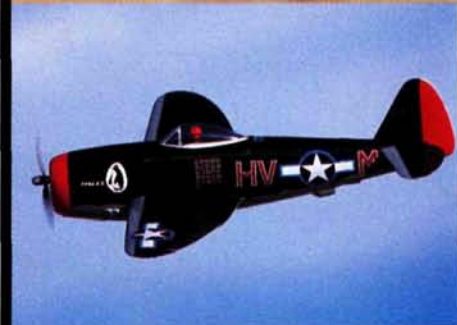
COMBAT-READY SPECS

	Model	Full-size
Wingspan	35.4 in.	32 ft. 4.5 in.
Length	29.8 in.	28 ft. 4.5 in.
Weight	18 oz.	4,189 lb.
Power	EPS-300C motor	DB 601Aa 12-cylinder
Price	\$59.99	\$2,000,000

We particularly like ...

- Molded-in panel lines and scale appearance.
- Easy to build and repair.
- Advanced aerobatic capabilities.

Flight performance ★★★★★
 Cool factor ★★★
 Scale appearance ★★★★★



HANGAR 9

AT-6 Texan ARF

Many believe that the AT-6 Texan was the most important U.S. aircraft of WW II. Sure, it was big and noisy, but once a student pilot had mastered the Texan, every other airplane—from the Mustang on down—was a piece of cake to fly. Hangar 9 has done a great job of reproducing the AT-6 in this ARF kit. The wood construction fuselage, the wing and the tail surfaces are all covered in a bright, Ultracote four-color scheme. Factory-installed retractable main landing gears are even included.

The AT-6's flight performance can best be described as being like that of an advanced trainer. The plane's slow-speed flight handling is wonderful, and even when made to stall, the plane doesn't show any nasty snapping habits. This Texan can do a wide array of aerobatics, including rolls, loops, point rolls, knife-edge, spins and snaps; it even flies well inverted. This is a very stable, enjoyable plane to fly.

"Takeoffs are very scale-like, and the AT-6 sure looks good during climb-outs."



COMBAT-READY SPECS

	Model	Full-size
Wingspan	67.5 in.	42 ft.
Length	48 in.	29 ft. 6 in.
Weight	8 lb.	4,158 lb.
Power61 2-stroke	Pratt & Whitney R-1340 9-cylinder
Price	\$254.99	\$155,000

We particularly like ...

- Retractable landing gear comes installed.
- Easy-to-see color scheme.
- Trainer stability; aerobatic performance.

Flight performance ★★★★★
Cool factor ★★
Scale appearance ★★★



COMBAT-READY SPECS

	Model	Full-size
Wingspan	65.25 in.	41 ft.
Length	51.5 in.	33 ft. 4 in.
Weight	8.5 lb.	9,205 lb.
Power91 4-stroke	Pratt & Whitney R-2800 Double Wasp 18-cylinder radial
Price	\$264.99	\$1,800,000+

We particularly like ...

- 90-degree rotating retracts are included.
- The unique looks of the scale Corsair outline during flight.
- Very stable slow-speed characteristics.

HANGAR 9

F4U Corsair .60 ARF

Who wouldn't want to fly this beautiful bent-wing legend? Hangar 9's attention to detail and quality is evident throughout this kit. With nice scale accessories such as a dummy radial engine, a scale cockpit, a detailed cowl, molded wing radiators and 90-degree retracts that come installed, it's easy to see why the F4U Corsair makes our top-10 list. And if you think its beauty is only skin deep, you'll find this is far from true when you get a chance to fly it!

This F4U Corsair really offers outstanding flight performance. Landings and takeoffs are relatively simple, and the low-speed characteristics are extremely stable. At full throttle, this plane really moves out and is very responsive to any stick movement. Then there is the outstanding flying profile created by that gull wing—unique to the Corsair. Once those rotating landing gears have been tucked up into the wheel wells, you can't help but feel that you're in the air for one purpose—to hunt the Zero.

"This Corsair has great flight performance and solid control response."

Flight performance ★★★★★
Cool factor ★★★★★
Scale appearance ★★★★★

HOBBY LOBBY'S ALFA MODELS

P-47D Thunderbolt

Affectionately referred to by its pilots as "the Jug" because of its large fuselage, this was one of the largest, fastest, most rugged and most heavily armed fighters of WW II. The Thunderbolt could take a tremendous amount of damage and still make it back to the airfield while offering its pilots tremendous firepower from its eight, 50-caliber machine guns. This small backyard flyer offers a unique color scheme along with some outstanding scale detail. The Alfa Model P-47D offers great scale detail in its molded, extruded-polystyrene-foam construction. The plane's wing, fuselage and tail feathers are all completely assembled and painted in a black, red and gray color scheme.

Even though the P-47D is a backyard flyer, it's richly detailed. It's also an outstandingly stable performer from launch to landing, and it's surprisingly fast for its size; it requires a flying field of a fair size. Its climb performance is impressive, and even when the battery power eventually runs out, you'll be equally impressed by its glide ratio.



"The Thunderbolt's great scale looks are equaled only by its realistic flight performance."

COMBAT-READY SPECS

	Model	Full-size
Wingspan	32.75 in.	40 ft. 9 in.
Length	28 in.	36 ft. 1 in.
Weight	16 oz.	10,600 lb.
Power	Graupner Speed 300 motor	Pratt & Whitney R-2800-59 Double Wasp
Price	\$119	\$1,500,000

We particularly like ...

- Superbly detailed and realistic appearance.
- Easy to assemble.
- Nice-looking color scheme.

Flight performance ★★★★★
Cool factor ★★★
Scale appearance ★★★★★

KYOSHO F-86F Sabre ARF

This is the only plane on our list that never really flew during WW II; the F-86 Sabre was, however, instrumental as a fighter during the Korean conflict. Kyosho's F-86F Sabre ARF is also the only ducted-fan warbird on our list. We knew we had to include it because of its cool looks and great color scheme. The kit includes a fiberglass fuselage, film-covered flying surfaces and a pull-start engine, tuned pipe and ducted-fan unit.

On hard surfaces, this plane takes off in about 75 feet, and once airborne, it builds up remarkable speed. Before you know it, you're making nice, low, fast, strafing runs. The plane will do a nice-looking roll, and it can do loops, but you must build up some speed before entry. Overall, the F-86F looks great in the air and sounds as though it's going much faster than it actually is.



"The F-86 looks and sounds as though it's going much faster than it actually is."

COMBAT-READY SPECS

	Model	Full-size
Wingspan	39.5 in.	37 ft. 1.5 in.
Length	38.2 in.	37 ft. 6.5 in.
Weight	3.6 lb.	10,845 lb.
Power	15 2-stroke	General Electric J47-GE-13
Price	\$319.99	\$450,000

We particularly like ...

- Excellent design and parts fit.
- Excellent power system.
- Nice scale appearance in the air.

Flight performance ★★★
Cool factor ★★★★★
Scale appearance ★★★

MODEL TECH

P-47D Thunderbolt

We know it's another "Jug" (as Thunderbolts were nicknamed), but we just couldn't leave this nice kit out of our top 10. The Model Tech P-47D Thunderbolt comes with a balsa-and-lite-ply-sheeted fuselage and built-up, balsa-sheeted wing and tail feathers. The plane is entirely covered with iron-on heat-shrink film and includes a fiberglass cowl, a belly pan and retractable landing gear.

Like its full-scale counterpart, the Thunderbolt is very stable and easy to fly. Even at slow speeds, there is very little reduction in control response. Its slow sink rate and moderate wing loading give it a smooth, predictable glide path that makes it a pleasure to land. Although not designed as an aerobatic plane, the Thunderbolt is capable of many scale maneuvers such as loops, rolls and spins.



"A great-looking, great-flying warbird."

COMBAT-READY SPECS

	Model	Full-size
Wingspan	67 in.	40 ft. 9 in.
Length	55.5 in.	36 ft. 1 in.
Weight	9 lb. 6 oz.	10,600 lb.
Power91 2-stroke	Pratt & Whitney R-2800-59 Double Wasp
Price	\$229.99	\$1,500,000

We particularly like ...

- Excellent flight performance and low-speed stability.
- Balsa-sheeted wings.
- Retractable landing gear included.

Flight performance ★★★★★

Cool factor ★★★★★

Scale appearance ★★★



MODEL TECH

P-51D ARF

Model Tech's P-51D ARF is an excellent example of a nice-looking scale warbird that flies extremely well. This all-balsa-and-plywood kit comes with a fully sheeted wing and solid-balsa tail feathers, and all of it is expertly finished with iron-on covering. Retractable main landing gear and an aluminum spinner are also included in this very complete ARF kit.

You'll enjoy flying this P-51D Mustang! It has very docile ground-handling characteristics and is easy to get into the air. Once it's airborne, this plane has the handling behavior of an advanced, low-wing trainer. Its slow-speed performance is excellent, and it can recover quickly from a stall. Its high-speed performance is also quite impressive; the plane is capable of any aerobatics that its full-size counterpart can do. Once you make your first low-speed pass and then pull up into a nice victory roll, you'll realize that you need to do that again and again.

"This sport-scale model maintains the scale outlines of the full-size plane and has an enhanced airfoil that provides outstanding performance."

COMBAT-READY SPECS

	Model	Full-size
Wingspan	57 in.	37 ft.
Length	51 in.	32 ft. 3 in.
Weight	6.5 lb.	7,635 lb.
Power61 4-stroke	Packard V-1650-7 (Merlin) 12-cylinder
Price	\$199.99	\$1,500,000

We particularly like ...

- Fully sheeted wings.
- Retracts and aluminum spinner are included.
- A great, stable-flying Mustang.

Flight performance ★★★★★

Cool factor ★★★★★

Scale appearance ★★★

THE WORLD MODELS

Zero G.S. ARF

The Zero (code-named "Zeke") dominated the skies across the Pacific to such an extent that for the first six months of WW II, it appeared to be unstoppable. This is one plane that any modeler would love to own, and The World Models Zero G.S. ARF makes that possible. This fine-quality kit comes with a fiberglass fuselage, cowl and tail fin complete with molded panel lines and a finished scale cockpit; a painted pilot figure is also included. The covered balsa built-up wings have retracts, flaps and ailerons already installed. If it only looked good, though, it would not be on our list; this baby can fly.

The full-size Zero was designed to be light and nimble to outmaneuver its opponents. This Zero G.S. is also designed to be an agile, nimble flyer; the controls are very responsive at both slow and high speeds, and it recovers quickly from a stall. When using the flaps on approach, it seems as if this plane floats forever, but when at last it stops flying, its wheels touch down lightly for a smooth landing. At full speed, the Zero is capable of all the basic warbird maneuvers and performs them with precision. You will enjoy flying this plane.



"The best thing about this plane is its performance in the air."

COMBAT-READY SPECS

	Model	Full-size
Wingspan	80 in.	39 ft. 4.5 in.
Length	67.7 in.	29 ft. 8.8 in.
Weight	15.5 lb.	3,704 lb.
Power	2.10 2-stroke	Nakajima Sakae 14-cylinder two-row radial
Price	\$549.99	Not available; only one Zero still flying

We particularly like ...

- Hand-painted fiberglass fuselage.
- Comes with retracts installed.
- Scale panel lines molded in the fuselage.

Flight performance ★★★★★

Cool factor ★★★★★

Scale appearance ★★★★★



TOP FLITE

Gold Edition P-51D Mustang

We know what you're thinking: why have two of the same warbirds in our top 10? Answer: because Mustangs were the hottest fighters in WW II! This ARF features simplified assembly while maintaining an accurate scale outline. The P-51 comes completely built up in major subassemblies and covered in MonoKote. The kit includes the fuselage, two wing panels and the tail surfaces. Good-quality hardware is included, as is a painted-fiberglass engine cowl and a belly air scoop, wing-to-fuselage fairings, a wing-center leading-edge fairing and main landing-gear doors. The wing is designed to accommodate Robart retractable landing gear, and it has formed wheel-well liners already installed. Fixed landing-gear hardware (including the tailwheel assembly) is also included.

Briefly, this 1/8-scale Mustang is a blast to fly; takeoffs and landings, though not effortless, are very manageable because of the model's relatively forgiving wing loading. The Mustang has very good low-speed performance for a big warbird, and powered by the ZDZ 40 engine and a Zinger 20x10 prop, it can do all scale and aerobatic maneuvers effortlessly.

COMBAT-READY SPECS

	Model	Full-size
Wingspan	84.5 in.	37 ft.
Length	73.5 in.	32 ft. 3 in.
Weight	19 lb.	7,635 lb.
Power	ZDZ 40cc gasoline	Packard V-1650-7 (Merlin) 12-cylinder
Price	\$499.99	\$1,500,000

"The Mustang is a 'point it where you want it' model that's very stable in all axes."

We particularly like ...

- Impressive scale appearance.
- Excellent instructions.
- Ease of construction.
- Awesome flight performance.

Flight performance ★★★★★

Cool factor ★★★★★

Scale appearance ★★★★★

Alfa Models; distributed by Hobby Lobby.
GiantScalePlanes.com (610) 282-4811;
giantScalePlanes.com.

Great Planes Model Distributors;
(217) 398-6300; (800) 682-8948; greatplanes.com.
GWS USA (909) 594-4979; gws.com.tw.

Hangar 9; distributed by Horizon Hobby Inc. (800)
338-4639; horizonhobby.com.

Hobby Lobby Intl. (615) 373-1444;
hobby-lobby.com.

Kyosho; distributed by Great Planes Model
Distributors; kyosho.com.

Model Tech; distributed exclusively by Global Hobby
Distributors; (714) 963-0329; globalhobby.com.

The World Models Mfg. Co. Ltd.; distributed in the
USA by AirBorne Models (925) 371-0922;

theworldmodels.com; airborne-models.com.
Top Flite; distributed by Great Planes Model
Distributors; top-flite.com. ✚

**This Leading Edge Gliders Curtiss
P-40 Warhawk was built and flown
by Joe Chovan of Syracuse, NY.**



'04 MIDWEST

➤ Soarers kick back in Kansas

by Dave Garwood

"Warhawks over Wilson" planes. Five entrants built 60-inch Leading Edge Gliders Curtiss P-40 Warhawks for the Foam Warbird Race, and Jack Cooper also brought 48- and 70-inch-span versions. Watch for an upcoming Model Airplane News how-to article on painting planes like these.



Fur ball action during the Foam Combat Contest—airplane division.



Wayne Henning (Bellevue, NE) launches during a heat in the Foam Combat Contest—flying-wing division.



SLOPE CHALLENGE

Slope soaring in Kansas? Are you nuts? Yes, Dorothy; slope soaring in Kansas! The topography around the Wilson Lake reservoir provides at least five primo flying sites that allow ridge lift in several wind directions. Also, it's windy in the heartland, and that's why Kansas has been the site of the Lincoln (NE) Area Soaring Society's (LASS's) Midwest Slope Challenge (MWSC) for 11 years—the longest-running slope-racing event in the U.S.

Sixty-one pilots from 13 states registered for the 11th consecutive outing of the MWSC, held May 13 to 16 at Wilson Lake in Lucas, KS; they traveled from as far west as Nevada and as far east as New

York. Though the MWSC is a major-league competition, that isn't all it's about; it's also a relaxed, RC-soaring vacation in rural America at one of the top-10 slope-flying venues in the country. Lucas is a town of 450 souls, all of whom give a warm welcome to the slope fliers who come to town. Many RC pilots greatly value the contrast between the low-key lifestyle in Kansas and the high-pressure work life that many of us experience in the more populous areas of the country. It's relaxing to spend a week flying gliders in Kansas, where approaching drivers actually give each other a friendly wave.

Do not, however, conclude that Kansas farmers are unsophisticated. If you think soaring guys watch the sky, consider for a moment how important the weather is to farmers. In a breakfast conversation at the K-18 Cafe, cattle farmer Jim Lawson commented that "Last night's rainfall was $\frac{1}{4}$ inch north of town, $\frac{1}{2}$ inch in town and $\frac{3}{4}$ inch south of town." How did he know that, when the National Weather Service's observations are not that detailed? The answer is that farmers have their own weather-observation instruments, and they compare notes over breakfast. The conversation then turned to the sunspot cycle and its effect on shortwave amateur-radio communications.

Jim Lawson invited us to fly on a north-west-facing hill on his property. It was a lovely grass-covered bowl with good landing areas at the top and on the slope face. "You guys can fly there this week; I've moved the cattle out of that field. Use my shop if you need to, also." For northeast winds, we've been flying in Kent Palmer's pasture for years. The U.S. Army Corps of Engineers operates many of the flying sites on the lake, where we're also given a warm

on designing, building and finishing EPP (expanded polypropylene) foam warbirds. Jack's planes look so good and fly so well that some fliers have a hard time believing they aren't fiberglass-molded planes, and he was generous in sharing his knowledge and experience. Now, on to the events.

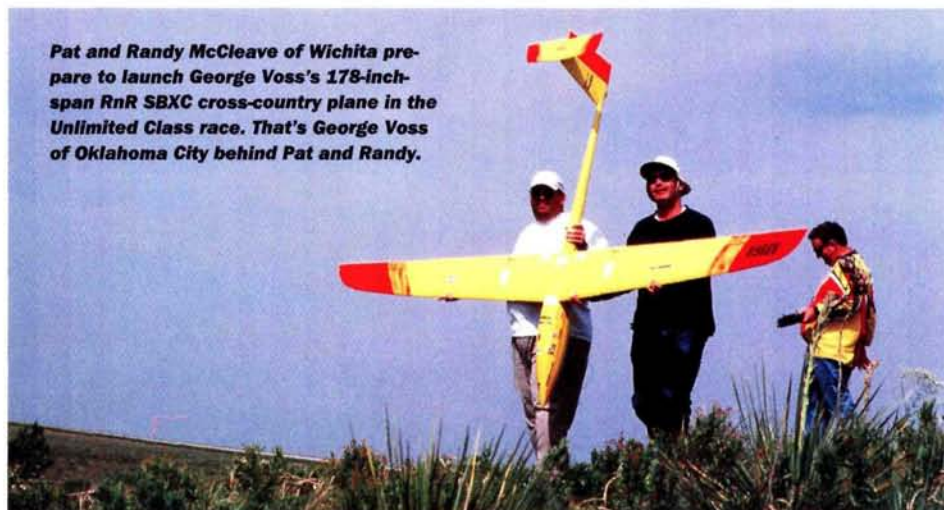
FOAMIE COMBAT

This is full-contact, knock-'em-out-of-the-air combat flown with specialized "bounceable" sailplanes. The gliders are made out of tough EPP foam, which quickly returns to its original size and shape after it has been struck or crushed. Most often, you can actually step on the



Greg Smith, Alden Shipp, Rich Loud, Joe Chovan and Wayne Rigby relax with DAW 1-26 foam sailplanes. These planes fly so well in a wide variety of lift conditions that some guys won't leave home without one. The 1-26 will be reintroduced by Sky King RC Products this fall.

Pat and Randy McCleave of Wichita prepare to launch George Voss's 178-inch-span RnR SBXC cross-country plane in the Unlimited Class race. That's George Voss of Oklahoma City behind Pat and Randy.



welcome and asked to follow a few sensible rules. These generous public and private land-use policies were much appreciated.

MWSC 2004's formal activities began Thursday night at registration, which was held this year at Alden Shipp's place. We were served fried turkey and were entertained and instructed by Jack Cooper—a honcho at Leading Edge Gliders—who offered an informal instructional session

wing of a combat foamie, pick it up and launch it, and it will fly fine.

Combatants score on opponents by striking an opposing aircraft hard enough to cause it to "depart from controlled flight" and hit the ground. The victor must then fly a loop or a roll to demonstrate that he's still in control before the next encounter. Sometimes, two or more planes become entangled and all go down,

Eight planes in the air is a typical heat in the Foam Combat Contest—airplane division. Here, pilots fly from the "main" hill overlooking Wilson Lake.



Race repairs. Mike Bailey (Maize, KS) and Jim Porter (of Iowa and Germany) quickly repair Mike's Supermarine Sea Fury foam warbird racer between heats. Mike kits this and other EPP-foam models.

but generally, no serious damage occurs, and the planes are relaunched to join the fray again. The pilot with the most "kills" wins the heat. Several 10-minute heats of eight to 10 planes are flown, and kill points are accumulated across heats to determine who will fly in the final heat. Scores are recalculated in the final round.

Because flying wings and conventional layout models (that is, those with tails) have distinctly different weight, flight and recovery characteristics, the MWSC runs two categories: one for flying wings and one for conventional planes. Contestants may enter both divisions, if they like.

On Friday morning, we began flying the combat events in a 15mph north wind at Palmer's pasture and managed one round of wing combat and one round of tail combat before the wind diminished to

light and variable, and organized events were called off for the day.

Saturday gave us steady 15- to 20mph southeast winds right up the main hill. We completed the preliminary rounds in each combat class and ran the final heat. Mark Blinde won the flying-wing division with a Frank Cavazos Boomerang, and Dave Day won the conventional plane division with an SR Hobbies BD-5.

ONE-DESIGN RACE

The One-Design Race (ODR) specification was developed by the Torrey Pines Gulls Soaring Club; it's designed to keep down the cost of a racing sailplane. ODR kits are available in both fiberglass and EPP foam. More and more, we are seeing original designs in ODR racing.

The ODR comprises three heats with four

planes flown in each heat plus a final round to determine the ultimate winners. Scoring in heats determines who may compete in the final round, in which the scores are recalculated. Winning places are determined by the order of finish in the final round.

A course is set up along the ridge with turn points at each end. Turn markers are sighting devices that "define a plane" perpendicular to the length of the racecourse. To complete a lap, the nose of the aircraft must "cross the plane" at both ends of the racecourse. Far turns are called by a group of four turn judges and signaled via a lighting system. Near turns are self-called and are verified by near-turn judges, who also keep the official lap count.

Each pilot has a caller who launches the plane, watches for traffic in the air and notifies him of the far-turn light signal. At the start of a race, callers hold up the sailplanes one at a time so the far-turn judges can identify them. Then the planes are launched and given about 30 seconds to gain as much altitude as possible; they will trade this altitude for speed by diving so that they're flying as fast as they can at the start of the race. A mechanical, audible countdown commences, and four planes dive onto the course to start the race.

Five laps are flown, and heat points are awarded according to the order of finish. Final standings are determined by finishing position in the final heat.

Lift conditions were excellent, and the races were close. In the end, Greg Smith bested the other competitors with a CR Aircraft Fun-1.

Racing finished around 4 p.m., and the main hill was then opened for fun flying. One memorable flight group was the

"Warhawks over Wilson" project, with four Leading Edge Gliders EPP-foam P-40 Warhawks flown together by Joe Chovan, Jack Cooper, Joe Hosey and Rich Loud. Larry Purdy built a fifth 60-inch Warhawk, and all five P-40s were flown the next day in the Foam Warbird Race. Jack has some impressive new planes, such as his P-40 Warhawk and P-63 Kingcobra kits; they fly so well and look so good that many observers were amazed to learn they were foamies—not fiberglass.

The Saturday-night banquet consisted of massive slabs of prime rib (Kansas is beef-eating country), and the festivities included a raffle, awards for races

Racing was hard-fought and close. In the final round, Pat McCleave from the winners' bracket flew his Breta Models NYX F3F against Greg Smith from the losers' bracket, who flew a Brian McLean Extreme. Greg won the first race, so another round had to be flown to determine the winner, as Pat had not yet lost a round. In the end, Pat and his NYX triumphed.

FOAM WARBIRD RACE

As Unlimited was finishing, the wind blew a steady 30mph with gusts over 40, according to some wind meters. It was a relief to have strong winds for this race

sponsors

California Sailplanes	Polecat Aeroplaneworks
J&C Hobbies	Quiet Flyer magazine
Leading Edge Gliders	SlopeFlyer.com
Lincoln Area Soaring Society	Soaring Specialties
Magnum Models	Trick RC
MidwestSlope.com	Up Slope Sailplanes
North County Flying Machines	Windrider Aviation

completed thus far and the traditional, annual MWSC suggestion-and-idea-generating meeting. The contest sponsors provided generous prize support, and we thank them heartily for this.

UNLIMITED RACE

Sunday morning brought 20- to 25mph southeast winds—a good sign for the 9 a.m. Unlimited Race, which was flown two sailplanes at a time with a double-elimination format. You had to lose twice to be out of the running.

This event tends to attract interesting entries, and not all racers are slaves to fashion or feel the need to field the latest "hot" design. In past years, thousand-dollar sailplanes have been challenged by foamies. This year, the sailplanes flown ranged in size from Wayne Rigby's wooden, 60-inch-span CR Renegade to George Voss's 170-inch-span RnR SBXC cross-country plane. They included purpose-designed racers, plank flying wings and DAW Ka-6E big foamie aerotow trainers. In Unlimited at MWSC, you "fly what you bring," and this only adds to the mirth and wonderment of participating in (and watching!) this event.

A pair of One-Design Race (ODR) planes rips through the near turn. Pilots are Joe Hosey of Wichita and Greg Smith of Milwaukee.



because in past years, it has been canceled due to lack of wind. With the strong wind and four good-looking planes running in each round, pilot and crowd excitement ran high.

The LASS boys erected the "Pole of Doom"—a 30-foot-high, galvanized-pipe structure with a 10-foot streamer tied to the top—and the contest director specified that pilots had to fly below the streamer at the near turn for a lap to count. Far-turn calling was performed by LASS workers using the light system.

With the strong wind and the "under-the-streamer" rule at the near turn, there were plenty of DNFs (relaunching is not permitted in MWSC racing events). There were several expertly flown rounds in which all five laps were completed and plenty of "grudge-match"-type friendly competitions as well. In the end, Jack Cooper, flying one of his own Leading Edge Glider 60-inch-span P-40 Warhawks, was the winner.

Brandon Koch (Hollywood, KS) relaunched a Sidewinder during a battle of full-contact combat in a heat of the Foam Combat Contest—airplane division.



UNTIL NEXT TIME ...

Now in its second decade, the MWSC continues to be a premier slope-soaring event, and Kansas continues to be a flying-vacation destination. Once again, we who participated are indebted to Loren Blinde and the LASS crew for organizing the event; to Alden and Joyce Shipp for the race assistance, registration and hospitality; to Jim Baker and his many volunteers for running the far turn; to Tom and Kelly Neill for T-shirts; to Tom Wild for building and maintaining the race timing and signaling equipment; and to Kent Palmer—the guy who allowed us to fly all week long in a working cattle pasture.

For more photos of the event, check out slopeflyer.com. For more detailed information on this year's MWSC and on next year's event when it is announced, see the LASS website at <http://home.alltel.net/mwsc>. ✦



FOR THE
WINNER'S
CHART



TOP FLITE

Giant-Scale

P-51D

BY GERRY YARRISH

A Gold Edition ARF

When you combine the words "Top Flite" and "P-51D Mustang," you know you have something special! Top Flite's long, successful history of producing excellent flying scale warbirds continues with this new giant-scale Mustang ARF. I've built several Top Flite Mustangs and had much fun flying these wooden kit-built fighters. Both the .60-size P-51 and the Gold Edition giant-scale version are well worth the building time and effort. Interested in saving time? You'll love the new quick-building $\frac{1}{5}$ -scale "Big Beautiful Doll."



The Mustang comes with all the major components covered and ready to assemble! Its nice workmanship is apparent throughout!



The kit comes with fixed main-wheel and tailwheel landing gear that drops into place in the slots provided for Robart retracts. You have a choice!



IN THE BOX

When you open the box, you can't help but think that someone has built and covered the kit version of the Mustang and then carefully packed it up for you to finish. The fuselage has the fin attached, and all the trim work has already been done. The black-and-white checkerboard on the front perfectly matches the painted-fiberglass engine cowl, and the anti-glare panel and pin-striping have also been applied. The wing panels, control surfaces and horizontal stabilizer are all completely covered and ready to install.

Also included are the instruction manual, a formed and painted canopy, a complete hardware package, painted fiberglass wing fillets, fixed landing gear and installation blocks, two sheets of stick-on decals, wheels, painted fiberglass landing-gear doors and air scoop, vacuum-formed cockpit parts, a fuel tank and an aluminum spinner—an excellent assortment of accessories, indeed.

WING WORK

To put the Mustang together, start by hinging the ailerons and the flaps to the wing panels. A nice feature of the wing is that the flaps and ailerons use recessed hinges. This produces a scale appearance without a lot of fitting or assembly work. Once these surfaces are in place, install



The main landing gear is in place in the wing. The Robart no. 622-5 units just slip into place. A plywood hatch covers the wing opening.

the wing servos, control horns and linkages. The wing features hatch-mounted servos, and only the servo arms are exposed. The flush-mounted hatch covers are held in place with six screws.

Before you join the two wing panels, install the Robart retractable landing-gear units and air lines. These units drop right

specifications

MODEL: giant-scale P-51D Mustang

MANUFACTURER: Top Flite

DISTRIBUTOR: Great Planes Model Distributors

TYPE: scale ARF

WINGSPAN: 84.5 in.

LENGTH: 73.5 in.

WEIGHT: 19 lb.

WING AREA:
1,245 sq. in.

WING LOADING:
35 oz./sq. ft.

RADIO REQ'D: 5- to 7-channel (rudder, elevator, throttle, aileron, flaps); retracts optional

RADIO USED:
Futaba 9C with S3001 and S9001 servos (total of 10)

ENGINE REQ'D: 2.1 to 2.8ci (34.5 to 46cc) 2-stroke glow or 2.5 to 4.3ci (41 to 70 cc) spark-ignition gasoline engine

ENGINE USED: ZDZ 40RV-L 40cc gas

PROP USED: Zinger 20x10

FUEL USED: 93-octane gasoline

PRICE: \$499.99

FEATURES: built and covered wings, fuselage and tail assemblies, fully sheeted balsa and plywood construction with painted fiberglass parts, factory-applied formed canopy, fixed heavy-duty-wire main landing gear; wing is designed for optional Robart retracts with functional landing-gear doors; tailwheel unit, scale 5-inch aluminum spinner, vacuum-formed cockpit interior kit, 32-ounce fuel tank, wheels, pushrods, wooden servo trays and wing joiner, adjustable engine mount, complete hardware package, photo-illustrated instructions and full-color, stick-on decals are also included.

COMMENTS: this almost-ready-to-fly, giant-scale warbird is a great value for the price. Instructions are clear, and it took me about 40 hours to completely assemble and outfit it with engine and radio gear! When it was time to balance the model, it required 3 ounces of ballast in the tail to put the CG as indicated in the instructions.

HITS

- Great looks.
- Excellent hardware package.
- Good quality of parts and craftsmanship.
- Excellent flight characteristics.

MISSES

- Covering wrinkles easily in sun.



Stick time in a Mustang

One thing that's often forgotten is that wars are usually fought by kids. In the case of WW II aviators, that meant they were also extremely inexperienced. When I flew my first fighter—which happened to be the Mustang—I was 29 years old and had nearly 2,500 hours of flight time in a wide variety of airplanes. When John Landers, the original pilot of "Big Beautiful Doll," flew his first fighter (a P-40—much more difficult than a Mustang to fly), he had barely 200 hours. By today's standards, that's not even enough flight time to dry him out behind the ears.

Of course, there's flight time and there's flight time. Not one airplane in Landers' logbook was as easy to fly as a Cherokee or a Cessna. Conversely, few airplanes I had flown prior to strapping on a T-6 to get ready for the Mustang were as difficult as the Stearman that Landers probably learned to fly in. The 208 hours he had accrued by the time he was flying combat in the Pacific in P-40s were a very serious 208 hours. When he was shot down and wounded by a Zero in December 1943, he was already an ace with six kills, and he probably hadn't cracked the 400-hour mark yet. At 400 hours, I was no more ready to fly something like a P-40 than the man in the moon.

There was a fatalistic, Darwinian aspect to WW II flight training and combat. Those with talent flourished, while others barely held on; many others were simply eliminated, leaving the strong to fight on. It's impossible for someone like me—a wannabe fighter pilot—not to wonder where I would have fallen in the Darwinian spectrum of fighter pilots.

When I finally got my chance to start flying Mustangs, it was a high point of my life, and all I was going to do was take off, fly around and land. It's a big deal to be one of the few who have been given that kind of opportunity. Not so in WW II. It was a given that someone like Landers, who may have been low time by our standards, could fly the airplane, but that wasn't what counted. What mattered was his ability to use the Mustang as a weapon. When he took off, he was going to pit his skill with the airplane against the best that Germany had to offer. It wasn't an ego thing; it was a survival thing.

When Landers started flying the Mustang, he was a 24-year-old lieutenant colonel and group exec of the 357th Fighter Group in the ETO. Earlier, while flying P-38s, he had added four German planes that, in addition to his

Japanese victories, made him a double ace. Then he moved over and became CO of the 78th Fighter Group and continued racking up the victories. When the War was over, he had 4.5 kills in the Mustang (the half was a shared Me-262).

I've looked over that long, skinny nose and shoved that barrel-shaped throttle forward to feel the seatback urging me forward. I've looped and rolled and, on occasion, even challenged another Mustang or Corsair to a fight. I've felt



PHOTO BY JOHN DIBBS/THE PLANE PICTURE CO. PLANEPIX.COM

the Gs and basked in that delicious soundtrack, but I always knew I'd come home. And that's the difference.

Most fighter pilots who were trained and fought during WW II didn't hit 1,000 hours by the War's end. Combat, however, makes you very good, very quickly. If it doesn't, adding time to your logbook will be the least of your worries. —Budd Davisson

ENGINE: ZDZ 40 RV-L

DISTRIBUTOR: RC Showcase

TYPE: single-cylinder gasoline engine

BORE: 38mm (1.5 in.)

STROKE: 35mm (1.37 in.)

DISPLACEMENT: 40cc (2.4ci)

WEIGHT: 2.9 lb. (3.4 w/ignition system)

HORSEPOWER: 4.8 @ 8,000rpm

PRICE: \$455 (inverted Pitts-style muffler—\$99.95; side-mount muffler—\$69.95)

ZDZ 40 RV-L

With its rotary-disc intake, rear-mounted carb and electronic ignition, the ZDZ 40 RV-L is a great choice to power the Top Flite P-51D Mustang giant-scale ARF. Distributed by RC Showcase, this 40cc (2.4ci) gasoline engine has been around for several years and has proven to be a light and powerful powerplant.

Reviewed in the December 2001 issue of *Model Airplane News*, the ZDZ 40 produces 4.8hp at roughly 8,000rpm and turns a Zinger 20x10 prop at approximately 6,900rpm producing gobs of thrust! Because of its relatively high compression ratio of 10:1, high-octane (93) gasoline is recommended to prevent fuel detonation. A 50:1 fuel/oil mix works best.



I modified the firewall to accept the ZDZ 40 RV-L engine by adding an engine-attachment box. The throttle servo is also installed in the firewall for a simple, straight-shot linkage setup.

into place, but you will have to wiggle them a little to get the air cylinders and lines to clear the openings cut into the wing ribs. Once you've pulled the air lines and the wing-servo extension leads through the center access opening, insert the wing dihedral brace and glue the wing panels together with 30-minute epoxy. I used Great Planes adhesives throughout the model's construction. After the epoxy

has cured, complete the wing construction by installing the main landing-gear doors and connecting the air lines with quick-disconnect and T-fittings.

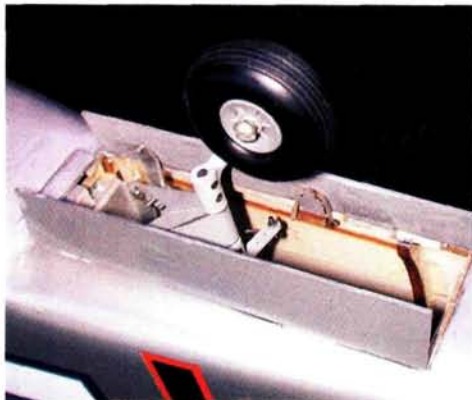
FITTING OUT THE FUSELAGE

The only major assembly work for the fuselage is to glue the horizontal stabilizer and hinge the elevators and rudder into place. Once this has been done, the

instructions suggest that you install the scale cockpit interior and the canopy, but I instead installed the radio gear and the control horns and linkage. Then I moved on to install the retractable tailwheel assembly and the pull-pull steering cables. The functional tailwheel gear doors are another nice scale touch; they open and close as the tailwheel mechanism is operated. Two metal arms attached to the



The tail surfaces feature airfoil cross-sections. The included heavy-duty control horns and 4-40 metal pushrods are shown.



The tailwheel is also retractable, and the gear doors close when the Robart gear is tucked up into place—a simple and effective setup.



tailwheel frame push the doors out of the way as the unit extends downward, and small rubber bands looped around plywood tabs glued to the doors and the fuselage interior snap the doors shut after the unit has retracted. Simple and effective!

FIREWALL FORWARD

The construction manual contains comprehensive instructions for installing a U.S. Engines 41cc gas engine, and the kit comes with plywood spacers for attaching this engine to the firewall. My choice for power, however, was the ZDZ 40RV-L. To install this 40cc gas engine with its rear-mounted carb requires that you first build a plywood engine box and then install it through the firewall and tie it into the next fuselage former. I made the box 3½ inches square by 8 inches long. The sides are made of ¼-inch birch ply, and the firewall face is made out of two layers of ¼-inch aircraft-grade ply laminated together. I drilled through the sides of the box into the edges of the firewall and installed lengths of ¼-inch birch dowel to tie everything securely together. I then cut a square opening in the main firewall and slid the box into place so that it extended 2¾ inches out from the firewall; this produced the necessary 7¾-inch spacing between the main firewall and the spinner backplate. Before I epoxied the box into place, I positioned it to give the engine 2 degrees of right thrust and 1 degree of downthrust.

I bolted the engine into place with four 10-32 cap-head machine screws and blind nuts. I drilled several large holes in the sides of the engine box and cut a large opening at the top of the firewall to allow plenty of airflow into the Bing carb. I used ½-inch-wide strips of ¼-inch ply to tie the back of the box into the second former just in front of the wing saddle. The fuel tank slid easily into place through the rear opening of the engine box, and the throttle servo is simply installed in an opening cut in the top of the main firewall. A short throttle linkage with two ball-link connectors connects the servo arm to the carb. I completed the fuel plumbing with an Excel Fuel Filler fitting from Slimline.

After you have installed your engine, trial-fit the engine cowl and then screw it into place. I stuck the spinner backplate to the front of the cowl with ¼-inch-thick foam tape and then slid the cowl into place. After I had installed the attachment screws, I removed the tape and had an even, ¼-inch gap between the spinner and the cowl. Because the ZDZ engine has a 6-bolt prop hub, I replaced the kit spinner with a custom-made Tru-Turn spinner. It came precisely drilled to match the prop-hub bolt pattern and machined prop openings in my Zinger 20x10 prop.

FINAL ASSEMBLY

Before you attach the wing to the fuselage and put on the belly scoop, install the

Bolt-in Robart retracts

Designed for ¼- and ⅜-scale P-51 Mustangs and similar aircraft, the Robart 622-5 (5-inch-offset strut) gear drop right into place in the Top Flite giant-scale P-51 Mustang's wings. Each unit is made of aircraft-grade aluminum and steel parts, has functional chromoly steel struts and features pneumatic operation with positive uplocks and downlocks. Each strut is adjustable for height and axle toe-in angle; \$269/pair.



SCALE STEERABLE TAILWHEEL

These pneumatic, retractable tailwheels are built in the same way as the large-scale mechanical tailwheels but include an air cylinder that's mounted on the frame of the tailwheel. All you need to do is run the air line to the tailwheel, mount your wheel, and you're ready to go. Item no. 160LWC—\$134.95 each.

STANDARD DELUXE AIR CONTROL KIT

This complete air-control kit can be used with any pneumatically operated (air) retracts. The kit includes: air tank, air line, fittings, retaining nuts, variable-rate control valve, fill port, check valve and fill fitting, two no. 190 quick-disconnects and the no. 173 On Board Pressure Gauge. Item no. 188VRX—\$71.95/set.

Robart retractable-landing-gear air system. This consists of the main air tank and the actuator valve and servo. The tank fits nicely into the laser-cut ply formers, and I glued it into place with PFM flexible adhesive. To make room for fuel-tank removal



and servicing, I moved the throttle servo/receiver/retract-valve tray aft and glued it into place just in front of the servos. I then attached the tailwheel-retract air lines to the main lines coming from the control valve with T-fittings, and I installed the quick-disconnects and secured all the air lines with cable ties and the supplied plywood brackets. I then placed the model inverted in a maintenance stand, filled the air tank and adjusted the control valve until the gear retracted and extended properly. Take your time doing this, as proper gear operation is a very important part of your model's future health, especially during landings.

RADIO GEAR

I used a Futaba 9C 9-channel radio system with 8, S9001 and 2, S3001 servos. I used a 9001 servo for each aileron, flap, elevator half, the rudder and the tailwheel steering and one 3001 servo each for throttle and retract-valve control. I chose the Futaba MSA-10 Servo Synchronizer to drive both the rudder-servo and the tailwheel-steering servo; this setup provided independent centering of the two servos. I used a Y-harness to drive both elevator servos as well as the two flap servos.

The aileron servos are connected to separate channels and are mixed to provide differential control (more up-travel than downtravel). I used a 1500mAh receiver battery pack and a 3000mAh pack to drive the engine's electronic-ignition system. For a last bit of security, I smeared all the servo-arm attachment screws with PFM to prevent them from vibrating loose. I also secured all metal-to-metal screws with Loctite.

FINISHING TOUCHES

My intrepid Mustang pilot is "Chuck"—a 1/4-scale USAAF pilot from Zombi Pilots. Distributed by Hangtimes Hobbies, it comes fully painted and detailed by hand! To create a more scale-looking interior, I

The cavernous radio compartment has room for all your radio gear as well as the retractable-landing-gear air system and its storage tank. In fact, there's room for two of everything!

made the rest of it out of bits and pieces of balsa and plywood. I used Tamiya "Color for Aircraft" paints to finish the inside of the pilot's main office.

The exterior of the model is decorated with a "Big Beautiful Doll" replacement decal set from Cajun RC. These custom-cut vinyl markings are very easy to apply, and after time, they release any trapped air bubbles from under the large markings.

Size Matters

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T-REX Locked Fuselage Cage



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Specs:

Wingspan	85"	2S Engine	40-50
Length	55.3"	4S Engine	50-65
Weight	7lbs	Radio Channels	4-7

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The best part of this impressive giant-scale ARF is how it flies. Powered by the ZDZ 40RV-L gas engine turning a standard 20x10 Zinger prop, the Mustang has impressive overall performance without being over-powered. The relatively light engine helps keep the model's overall weight down and, in so doing, improves its already attractive wing loading.

TAKEOFF AND LANDING

The Mustang has no tendency to nose over while taxiing, and the tailwheel (in its scale location) provides excellent steering response. Throttle is best advanced slowly to minimize the amount of right rudder needed to keep the takeoff roll straight. Those who are unfamiliar with tail-draggers might be surprised by its desire to turn left when the power is slammed full on. With no flap deployed, the model requires a gentle pull on the stick to become airborne, but this can quickly be relaxed after it has gained some altitude. Pulling the landing gear up does not noticeably affect the model's pitch trim.

Landing the Mustang is a more involved procedure than that used to land a sport model; you have to think it through. First, set up your traffic pattern and reduce throttle to about $\frac{1}{3}$. On the upwind leg, drop the flaps to $\frac{1}{2}$, and hit the landing-gear switch. I like to make a 180-degree turn in front of myself so I can see the gear come down. Then, on the downwind leg, drop flaps to full before making the turn to base. Here you will see how nicely full flaps slow the model but don't allow its nose to



come up. On final, adjust throttle for a constant descent rate, and fly it to the threshold of the runway. When it's about 10 feet above the ground, slowly start flaring to a level attitude, and let the model settle in on the mains. Then pull the throttle to idle, and stay on the rudder until the tailwheel comes down. Nothing to it really, but you should be on the sticks all the time.

LOW-SPEED PERFORMANCE

At reduced speeds, the Mustang remains very controllable. With some differential aileron dialed in, hardly any rudder is needed to make graceful turns. The mission here is to stay smooth on your control inputs. Ailerons remain effective all the way to the stall, but you will drop a wing slightly if you aren't straight and level at the break. Recovery is a non-event.

HIGH-SPEED PERFORMANCE

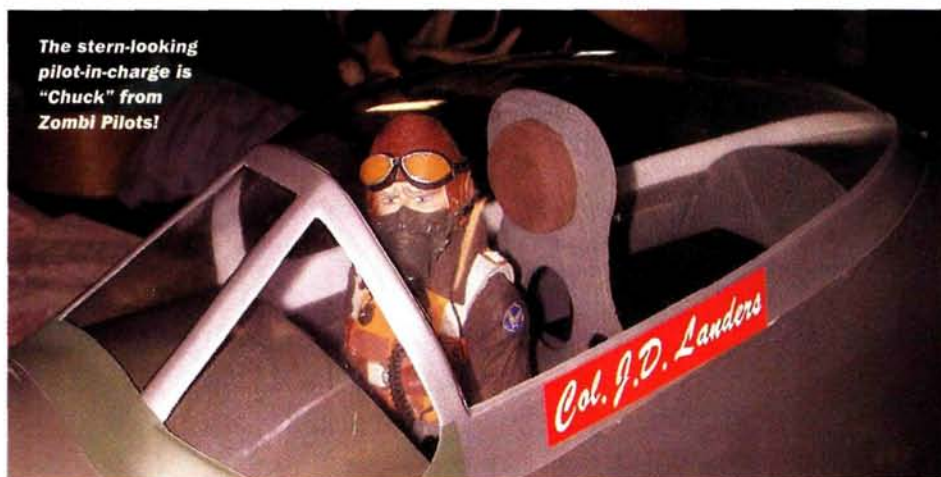
I must admit, there's nothing quite like the feeling of dropping the Mustang into a low, high-speed pass. I could almost hear the .50-calibers as I made my first strafing run! The Mustang is a "point it where you want it" sort of model, and it's very stable in all axes. With the gear and flap up, you can really get a good head of steam going. Control is positive, and set at the recommended throws, the model feels well balanced. Again, try to be smooth with your inputs.

AEROBATICS

You name it! Big loops, Cuban-8s, wingovers; there's power to spare, and the model can do it all. Roll response on low rate is about 180 degrees per second, and this is what I like for the first flight of a model of this size. Inverted flight requires only a slight forward-stick pressure. There's no need for a Mustang to perform 3D aerobatics. Flown as a scale fighter, it can make very aggressive moves on high rates without the risk of its falling out of a maneuver. But yanking on the stick can earn you a high-speed stall condition. Full power should be used on the uplines, and reduced power settings on the way down help prevent stresses from building up! If you want to impress your buddies at the flying field, do some slow horizon-to-horizon rolls.

The editors wish to extend their thanks to Stan Kulesa and the members of the Westchester Radio Aero Modelers (WRAM) Club for kindly allowing use of their flying field in Patterson, NY.

The stern-looking pilot-in-charge is "Chuck" from Zombi Pilots!



Because they lack any clear carrier backing, the markings have a crisp, painted-on look.

As if having a giant-scale P-51D Mustang weren't enough by itself, the new Top Flite giant-scale ARF is a great way to get into warbirds. Its great flight performance, relatively light wing loading, flaps and pneumatic retractable landing gear offer valuable

setup experience. From its basic assembly to its first takeoff and landing, I am sure you'll find that the 40-odd hours it took to put together were very much worth the effort! Watch out for that bogey at 6 o'clock! ✈

Cajun RC (337) 269-5177.

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SEE THE
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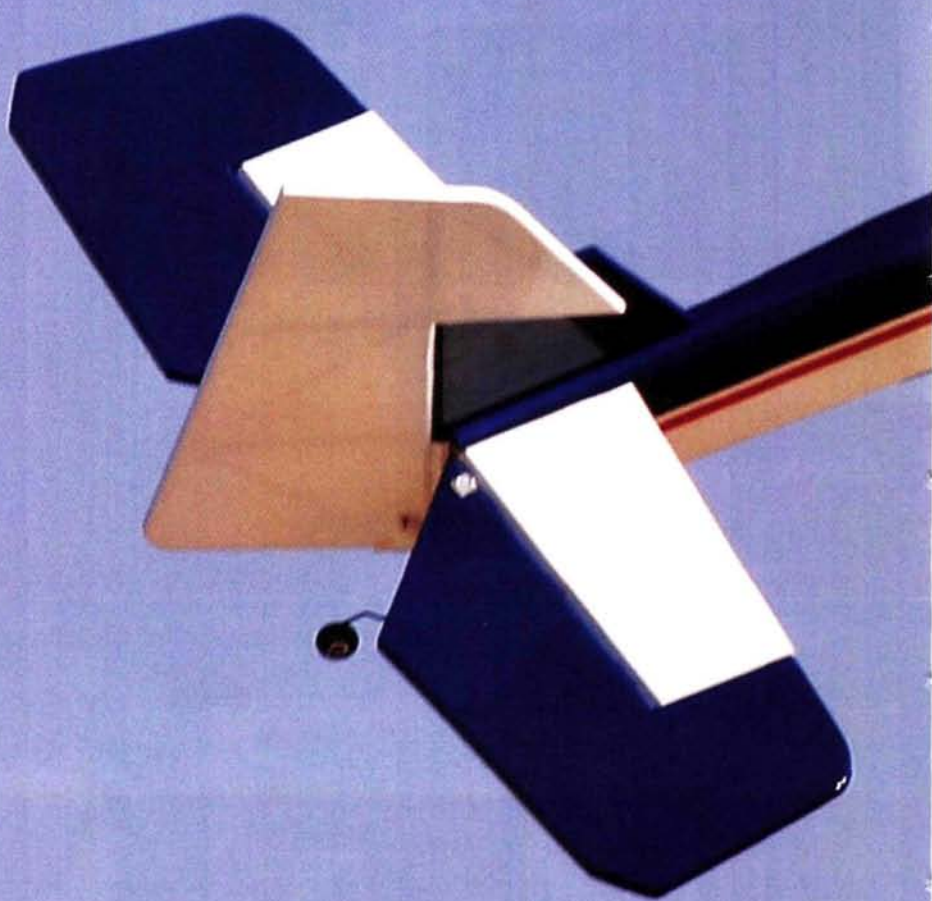
BY JOE WELSH

Fun Fly

90S ARF

Nitro-powered 3D blast

Large planes are often the best flyers. Their size makes them stable and predictable, thereby encouraging pilots to fly ever closer to the ground. Combine this stability with a plane that's designed for wild aerobatics, and you have a real crowd-pleaser. Model Tech has created a combination like this with its Fun Fly 90S ARF kit. In the tradition of the fun-fly style of aircraft, this plane has plenty of power and huge control surfaces for extreme aerobatics.





WHAT YOU GET

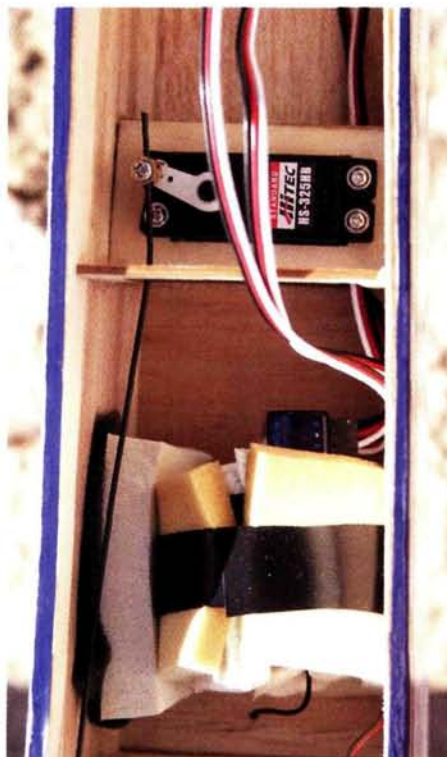
When you open the box, you'll find a fully covered, built-up balsa and lite-ply fuselage with matching tail surfaces and a few bags containing the landing gear, main wheels, a steerable tailwheel, pushrods, a fuel tank and almost everything else you will need, including a detailed manual. Underneath these are two wing panels with the ailerons temporarily set into place on their CA hinges. I found only very small wrinkles in the MonoKote covering, so I checked the box and found that the entire plane is covered in genuine MonoKote covering. The wings and fuselage were nice and straight, probably because the kit is laser-cut to ensure that airframe components fit together precisely. When the airframe components fit well, it reduces assembly time because few, if any, modifications are needed.

ASSEMBLY

Although the plane is large, assembly time is less than that needed for many smaller planes because the basic construction steps are the same and there is so much room to work inside the large fuselage. Model Tech has completed many steps for you, such as cutting the pushrods to the proper length and installing blind nuts for the wing bolts, the landing gear and the engine mount. These nice touches help get you to the flying field more quickly.

- **Fuselage and servos.** Good detail in the illustrated manual takes the guesswork out of assembling the Fun Fly. The only procedure I did differently was to install the landing gear, tailwheel and engine toward the end of the assembly process to keep them out of the way. I first installed the horizontal and vertical stabilizers, and then I hinged the elevators and rudder with the included CA hinges. The quality of the kit was evident here; the slots for the hinges had been cut in the right places, and I did not have to make any modifications to get the hinges to fit.

I bought fast, powerful, ball-bearing servos for this aerobatic plane because you need fast control response to get the most out of it. It is especially important to have good servos in the tail section; they will be called on to strut their stuff when it's time to hover. The laser-cut servo trays fit the standard servos perfectly without modification. Once the servos were in, I linked the pushrods. All the linkage hardware is included in the kit, and there aren't any surprises. The Fun Fly uses a split elevator and two wheel collars to create a "Y" in the elevator pushrod. I used a



The servo trays all come installed, and there is plenty of room to work in the large fuselage.

little medium-strength (blue) thread-lock on the threads of the wheel collars for good measure, and after that, it was time to move onto the wings.

- **Wings and servos.** The wings are assembled in the traditional fashion. First, I test-fit the joiner in the wing panels and found that no modification to the joiner was necessary for a good fit, so I glued the wings and joiner together using 30-minute epoxy. I then hinged the ailerons with the CA hinges, mounted the servos and connected the control rods. The wing went together without a hitch. This is a two-servo wing, and since I have a programmable radio, I connected the servos to separate channels instead of using a Y-harness on the servo leads. Having done that, I can program elevon mixing for aerobatic maneuvers (such as the harrier and elevator) at the transmitter. Though none of this mixing is required to fly, it adds another dimension to what the plane can do, and this means more fun for its pilot.

- **Engine and final assembly.** The firewall comes with the blind nuts already installed, and they fit my Magnum XLS .91 perfectly, so engine installation was easy. If you use a different engine, you might have to plug the holes and drill new ones where you need them. The firewall has a little downthrust and right thrust built into it, so you won't have to

specifications

MODEL: Fun Fly 90S ARF

TYPE: aerobatic sport flyer

MANUFACTURER: Model Tech

DISTRIBUTOR: Global Hobby Distributors

WINGSPAN: 61 in.

LENGTH: 58 in.

WING AREA:
1,100 sq. in.

WEIGHT: 6.6 lb.,
as tested

WING LOADING:
13.82 oz./sq. ft.

ENGINE REQ'D:
.60 to .91 2-stroke

ENGINE USED:
Magnum XLS
.91 2-stroke

RADIO REQ'D:
4-channel (or
more) w/5 servos

RADIO USED:
Futaba 9CAP
with Hitec
Electron 6
receiver and 5
servos (elevator,
rudder, ailerons
[2], throttle)

FUEL USED: Omega 10% nitro

PRICE: \$199.99

FEATURES: covered in MonoKote; laser-cut parts for above average components fit; excellent instruction manual; comes with all necessary hardware, including wheels and cut pushrods with Z-bends already made.

COMMENTS: excellent stability makes the Fun Fly a great choice for practicing your precision flying. It will do all the standard aerobatic maneuvers, and hovering could not be easier. It's light, but its airframe is tough enough to accumulate plenty of flight hours.

HITS

- It's big.
- Kit quality is excellent.
- Stable yet aerobatic.

MISSES

- None.



worry about that. With the engine mounted, I installed the throttle servo and linkage according to the instructions.

A quick check of the plane's balance revealed that it would be a bit tail-heavy, so I mounted the battery at the front of the fuselage, right next to the included fuel tank. The fuel tank fits perfectly; put

Given the Fun Fly's size and large control surfaces, I expected it to live up to its name, and I wasn't disappointed. This rock-solid plane can be made to fly almost as easily as a trainer, and with a little radio programming, it can be a blast when doing aerobatics.

TAKEOFF AND LANDING

After a few jokes with John Reid along the lines of "I wonder whether it will get off the ground," I let the plane roll a foot or two and then punched the throttle. It was off the ground in a gentle climb before I even thought about pulling up, and it was travelling just as straight as could be. It needed only two clicks of aileron trim for perfectly straight and level flight. I pulled up into a nearly vertical climb just because I could.

Landings could not be easier. The Fun Fly is very maneuverable, and with a little exponential programmed into the control surfaces, landings are completely tame. The plane slows down

nicely in the standard configuration, but I also experimented with flaps (flaperons). With the flaps extended, landing speed was reduced even further, and with a click or two of power, the plane was able to harrier to the ground at a mere crawl.

LOW-SPEED PERFORMANCE

With its thick airfoil and generous wing area, the Fun Fly excels at slow flight. It can crawl around the sky and remain completely stable. I was initially concerned about the slight dihedral in the wing, but the plane was quite stable even when inverted. The ultimate slow flight is the hover, and this plane is one of the easiest to hover that I have flown.

HIGH-SPEED PERFORMANCE

The Fun Fly is designed to fly slowly, and its aerobatic wing causes considerable drag by design, but bolt on a .91 engine, and anything will move fast—including this plane. I found a use for this speed when practicing large-diameter loops directly over the runway. It takes skill to make those loops look good, and I plan to continue practicing with the Fun Fly.

AEROBATICS

Glad you asked! All the major aerobatic moves are "spoken" here. The plane will climb in a knife-edge and hover at about 1/2 throttle. I did about as many tumbling maneuvers as I could think of. Snap rolls are not quite as violent as I have seen in certain other aerobatic aircraft, but the plane doesn't have any of the bad tendencies that some of these have; it was easy to recover from even the ugliest situations. My CG is almost on the forward CG mark. I'm eager to see what the plane will do with the CG moved all the way back to the aft mark.



The Magnum .91 has plenty of power; it started on the first try and has run great ever since.



The Fun Fly 90S comes with a steerable tail-wheel and standard, easy-to-use, fully adjustable linkages.



foam around it to protect it from vibration. About 1/8 inch behind the fuel tank, I glued a piece of balsa to the fuselage floor and put a piece of foam between the balsa and the tank to prevent the tank from sliding backwards. I installed the receiver just behind the tank and then mounted the tailwheel and main gear. The only part of the plane that took some time was the spinner, which is not included. Model Tech recommends a 2.5-inch spinner; I had to cut the one I bought considerably to make it fit my prop. A 3-inch spinner might have fit better. Once the prop and spinner had been mounted, it was time to break in the engine and fly.

FINAL THOUGHTS

This plane definitely has a size advantage over smaller aerobatic planes. Its long tail moment gives it considerable stability, and you will feel that stability through the entire flight envelope from fast flight to slow flight to aerobatic flight. Good stability coupled with a low price tag makes the Fun Fly a great plane with which to practice precision flying as you progress toward becoming a pro.

The high quality of the kit is evident. The plane's aerobatic performance is not the very best that money can buy, but you don't have to be an expert pilot to fly aerobatics with it. If you can put the transmitter down long enough to let someone

else pilot the Fun Fly, you'll see that it also makes a great aerobatic trainer. But don't share it until you've had a chance to fly it yourself for a while. ✈

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**THE WORLD
MODELS**

Sky Raider

BY PETER ABBE

Mach I



Fly better with this aerobatic sport trainer

The World Models Sky Raider Mach I is an inexpensive, entry-level model designed to take novice pilots from their first flight into the world of basic aerobatics. Featuring a low wing loading and a semisymmetrical airfoil, the Mach I offers gentle flight characteristics and aerobatic potential far superior to that of most trainers. Combine this performance with a complete hardware package, high-quality components, fast assembly time and a price tag just under \$70, and you have a value that's hard to pass up.



The Evolution .46 fits perfectly in the nose. The plastic spinner supplied with the kit provides vibration-free operation.

KIT CONTENTS

The Mach I is available in yellow and white color schemes; I received a white one. It comes neatly packed with all components, hardware and decal sheet sealed in plastic bags. The wings, fuselage and tail feathers are nicely covered and trimmed with a lightweight, repairable iron-on covering, and all control surfaces are factory-installed with pinned hinges. The World Models has done a good job of building these components as light, strong and accurately as possible. A complete hardware package contains nuts, bolts, pushrods, clevises, control horns, wheel collars, wheels, engine mount, fuel tank, spinner and even foam for mounting your radio and battery. You need only supply a 4-channel radio system, engine, propeller and fuel lines. The 11-page, illustrated instruction manual was easy to follow, although the lack of detailed text may make some assembly steps confusing for true beginners.

• **Wing assembly.** The wing halves are joined with epoxy and a hardwood dihedral brace; a factory-installed pin ensures accurate alignment. Once the epoxy has set, you must screw the aileron servo onto two plywood plates, which you must then glue to the bottom surface of the wing. All that remains is to connect the pushrods to the preinstalled aileron torque rods.

The wing's plywood center ribs double as the leading-edge hold-down, and the trailing edge is retained with two bolts. The bolt-holes were accurately drilled, and the wing aligned perfectly with the fuselage.

• **Tail feathers.** To mount the tail feathers, you must remove several small portions of covering and a support block in the tail of the fuselage. Then you can slide the stabilizer and fin into their respective slots and retain them with two steel bolts that are passed through holes in the base



The fuselage has ample space for all the standard gear. The plywood servo tray is installed, and foam is supplied for mounting the radio and battery.

of the fuselage. I needed to slightly enlarge one of these mounting holes to achieve proper alignment. Coat these bolts with thread-lock to prevent them from vibrating loose.

• **Fuselage.** Completing the fuselage is a simple matter of installing the fuel tank, engine, landing gear and radio. After you've assembled the fuel tank, you slide it into a plywood former in the model's nose and retain it by gluing a small balsa stick into place.

The supplied four-piece adjustable engine mount doubles as the nose-gear bracket and easily accommodates the Evolution .46 engine I used. I substituted 6-32 cap-head engine-mounting bolts for the supplied Phillips-head bolts.

After you've passed the nose gear through

specifications

MODEL: Sky Raider Mach I

MANUFACTURER: The World Models

DISTRIBUTOR: Airborne Models

TYPE: beginner/intermediate trainer

WINGSPAN: 65.5 in.

WING AREA: 737 sq. in.

WEIGHT: 5 lb. 4 oz.

WING LOADING:
16.4 oz./sq. ft.

LENGTH: 53 in.

ENGINE REQ'D:
.40 2-stroke

ENGINE USED:
Evolution .46

RADIO REQ'D:
4-channel
w/4 servos

RADIO USED: JR
Quattro transmitter
w/ Hitec HS-311 servos

PROP USED:
APC 11x5

FUEL USED:
PowerMaster

PRICE: \$69.99

FEATURES: built-up balsa and plywood construction; lightweight iron-on covering; factory-installed control surfaces with pinned hinges; hardware; fuel tank; engine mount, spinner; illustrated instruction manual.

COMMENTS: the Sky Raider Mach I is a fantastic entry-level and intermediate trainer. Its high-quality components quickly assemble into a lightweight plane that's well-suited to the novice pilot. This model provides maximum value with minimum investment.

HITS

- Wide flight-performance envelope.
- Easy assembly.
- Complete hardware package.

MISSES

- Instruction manual lacks detail.

the center of the engine mount, you retain it with two wheel collars. To actuate the gear, you'll need to install a nylon control arm. Mount the main gear on a hardwood block in the fuselage and hold it in place with two nylon straps. The 2½-inch wheels are light foam and fairly small in diameter, but I didn't have any trouble flying off grass or pavement.

The Hitec HS-311 servos I used fit perfectly in the factory-installed plywood

TAKEOFF AND LANDING

The Mach I tracked well on short grass as well as on pavement; steering was positive yet not oversensitive. Taking a little extra time to ensure that the nose gear was properly aligned provided very straight tracking during the takeoff roll. If you simply advance the throttle and slowly apply a touch of up-elevator, the model will rotate when flying speed is achieved.

Because of the wing's semisymmetrical airfoil, landings are slightly faster than most trainers'. All controls remained positive at slower airspeeds, and the plane handled crosswind landings very well. The APC 11x5 propeller acts as an effective brake and allows the airspeed to be reduced from cruising to landing speeds



very quickly. Although the Mach I is not difficult to land, careful throttle management is essential for a smooth touchdown.

LOW-SPEED FLIGHT

Because of its low wing loading, this model can tolerate low-speed flight very well. Stalls are not violent, but holding the nose too high with the engine at idle will result in the model's dropping a wingtip. Be sure to feel out stall characteristics at a safe altitude; this model is not a floater!

HIGH-SPEED FLIGHT

With the Evolution engine turning an APC 11x5 at 12,500rpm, the Mach I can really move out. Requiring a bit of downtrim to maintain high-speed level flight, it is stable, tracks very well and exhibits no sign of flutter. With this engine and prop combination, any power settings over 1/2 throttle are fast; at full throttle, vertical is nearly unlimited.

AEROBATICS

This model's aerobatic potential sets it apart from most other trainers. It tracks well through loops and requires only a little down-elevator throughout the inverted portion of rolls. Outside loops are possible, and inverted flight is solid. Spin recovery is fast, and snap rolls end with the model in an upright position. If that isn't enough, increase the rudder deflection to 30mm, go to full throttle, and the Mach I will knife-edge the entire length of the runway with minimal pitch and roll coupling. This is a trainer that students can enjoy long after they have soloed!

step up to aerobatics with the Mach II



With the Sky Raider Mach II, transitioning from your trainer into the world of aerobatics couldn't be easier. Featuring a light wing loading, semisymmetrical airfoil and low wing configuration, this model is the perfect next step. It is both a stable sport model and a hot aerobatic performer. Like the Mach I, it's available in a yellow or white scheme and costs \$69.99.

If you assembled the Mach I, you won't have any trouble assembling the Mach II. Other than mounting the wing on the bottom of the fuselage, the only significant difference in assembly is the undercarriage configuration. Because it doesn't have nose gear, this model actually goes together faster than its sister ship. My total assembly time was approximately four hours, and that included the time it took to transplant the engine and radio gear from the Mach I!

I set up the aileron and elevator control throws and balanced the model exactly according to the manual; no additional weight was needed. I did increase the rudder throw to 30mm to maximize the model's aerobatic potential.

The Mach II's ground-handling is excellent both during taxiing and takeoff rolls. The rudder is effective yet not oversensitive—even with the narrow

stance of the main gear. I observed no tendency for the model to ground-loop. This plane slows down nicely, but it will not tolerate low-speed high-nose flight without tip-stalling. Proper throttle management and avoiding a nose-high attitude during landing are essential for smooth touchdowns.

Powered by the Evolution .46, the Mach II is fast and has unlimited vertical performance. Rolls are only slightly less than axial, and the model tracks very nicely through loops and vertical maneuvers. Snaps and spins are crisp, and recovery is virtually immediate. The model handles equally well inverted as it does upright. The rudder has sufficient authority for respectable slow rolls, point rolls and sustained knife-edge flight.

Whether you're a novice looking to move up to your second airplane or an experienced pilot looking for something new with which to carve up the sky, the Mach II can satisfy your desire. Its outstanding flight performance makes it an ideal model for sharpening your flight skills, regardless of your skill level. After mastering the Mach I and Mach II, novice pilots will be ready to move up to the world of high-performance sport and scale aircraft!

servo tray. The rudder and elevator pushrods are steel wires that ride in nylon tubes; these linkages were easy to install and provided a tight, slop-free setup. I did replace the steel throttle pushrod with a Sullivan flexible Nyrod to eliminate the possibility of transmitting engine noise to the receiver. By mounting the battery beneath the fuel tank and the receiver behind the servos, I was able to balance the model perfectly without any added weight.

CONCLUSION

The Sky Raider Mach I is a complete, high-quality ARF that can be assembled in a very short time. Its flight performance is fantastic, and its price makes it a value that is hard to pass up! Student pilots should be warned, though: if you show up at the field with this airplane, you may have to wrestle the transmitter out of your instructor's hands! ✚

APC props; distributed by Landing Products (530) 661-0399; apcprop.com.

Evolution; distributed by Horizon Hobby.

Hitec (858) 748-6948; hitecrrd.com.

JR; distributed by Horizon Hobby Inc.

Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

PowerMaster Hobby Products Inc. (512) 285-9595; powermasterfuels.com.

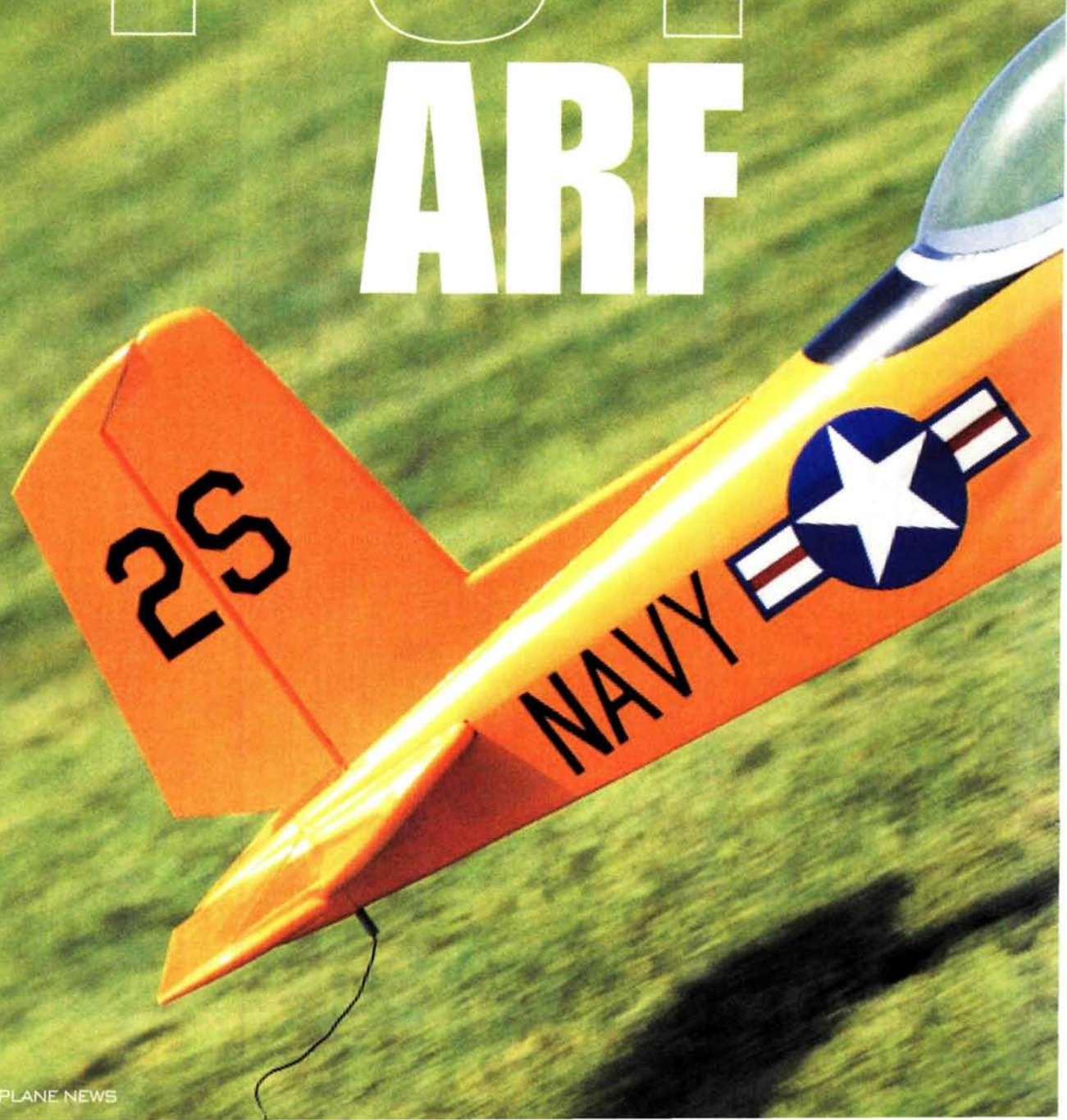
Sullivan (410) 732-3500; sullivanproducts.com.

The World Models; distributed in the USA by AirBorne Models (925) 371-0922; theworldmodels.com; airborne-models.com.

HANGAR 9

BY RODNEY ROY

T-34 ARF





A military trainer turned multi-capable ARF

Built by Beechcraft, the T-34 Mentor was the U.S. military's primary trainer during the 1950s. So if you know someone who was a pilot in the U.S. Navy, Air Force, Marines, or Coast Guard during the Iron Curtain or Vietnam War era, they most likely learned how to fly in a T-34 Mentor. The Hangar 9 ARF version is reminiscent of the planes that buzzed over Pensacola in the '60s, as it retains not only the full-size Mentor's scale look but also its excellent sport aerobatic performance.



WHAT'S IN THE BOX

There is no doubt in my mind that ARFs are getting better, and the T-34 proves it. Its balsa and ply construction comes fully covered in "Cub" yellow and black Ultracote. The kit comes with just about everything you need to complete it, including the fuel tank, a generous hardware supply, all pushrods and a 3-wheel gear; a complete retract gear assembly is available as an option. You need only supply a radio, an engine, a propeller and spinner. The instruction booklet is very well-written and has many detailed photos and diagrams that cover all stages of assembly.

ASSEMBLY

One of the first things I do on most ARFs is to reshrink the covering. This is not the fault of the covering or the manufacturer; it's just the nature of heat-shrink covering when it undergoes temperature changes during shipping.

The first thing to assemble is the wing. After I assembled the dihedral braces with 30-minute epoxy, I test-fit the wing panels. My dihedral braces fit perfectly. Each aileron is controlled by its own servo, and there are cutouts in each wing panel for the servos. All I had to do was remove the covering over the cutouts. There wasn't any string in the wing for the servo wires, so I strung one string in each wing panel before I glued them together because it is much easier to do before the wings are joined. I found that 9-inch extensions



I picked a Saito .65 engine for my T-34. The engine installation instructions are extensive but do not specifically cover 4-strokes, so a little improvisation was required.

(plus a Y-harness) were long enough to reach the receiver. In the wing, where the servo lead and the extension connect, I tied them together with dental floss to eliminate any chance of their coming apart in flight. Next, I used some 30-minute epoxy to join the wing halves.

Once the wing was all set to go, I trial-fit it to the fuselage and was pleased that it lined up perfectly. The mounting holes for the wing hold-down bolts lined up exactly with the blind nuts in the fuselage. The next step is to attach the ailerons with the supplied CA hinges. The slots have already been cut. One thing I

specifications

MODEL: T-34 Mentor

MANUFACTURER: Hangar 9

DISTRIBUTED BY: Horizon Hobby

MODEL TYPE: sport-scale ARF

LENGTH: 45 in.

WINGSPAN: 57.25 in.

WING AREA:
555 sq. in.

WEIGHT: 7 lb.

WING LOADING:
29.05 oz./sq. ft.

ENGINE REQ'D:
.40 to .58
2-stroke, .56
to .72 4-stroke

ENGINE USED:
Saito .65
4-stroke

PROP USED:
Master
Airscrew 12x8

FUEL USED:
Wildcat 2 &
4 cycle

RADIO REQ'D:
4-channel with
5 servos (7
with retracts)

RADIO USED: JR
XP8103 and 5
JR 537
standard BB servos

PRICE: \$170

FEATURES: all-wood, 90-percent-built ARF covered with Hangar 9 Ultracote in "Cub" yellow and black. The low-wing, flat-bottom airfoil is equipped with dual-aileron servos and a wing that bolts up with 1/4-20 nylon bolts.

COMMENTS: the Hangar 9 T-34 is a high-quality, easy-to-build ARF. I thoroughly enjoyed building and flying this semi-scale warplane and would highly recommend it to any sport flier who wants a plane with style and history.

HITS

- Great overall appearance.
- High-quality construction and covering.
- Excellent step-by-step instruction manual with photos and diagrams.

MISSES

- None.

like to do is run a 3/32-inch drill bit in the center of the slot to allow better CA flow. I mounted the servos in the wing panels and then installed the control horns. Next, I assembled the control rods. One



end is attached with a supplied nylon clevis, and then you have to mark the servo end, make a 90-degree bend and attach this to the servo horn with a supplied link. This way, the adjustments are easy to make. All that was left to do was to drop in the landing gear. The fixed gear fits nicely into place. The wheel wells are already cut into the wing panels, so if you want to install retracts instead of the fixed gear, all you need to do is cut away the Ultracote covering and bolt the Hangar 9 units into place. It's good to have a choice.

- **Tail.** When you assemble the tail, you first have to drill a hole in the horizontal stabilizer. Be careful when you do this; the rudder-torque control rod will pass through this hole. I found that the hole had to be enlarged slightly to facilitate installing the rod through the stabilizer. I then dry-fit all the parts to make sure that they fit and were aligned properly. Once this was done, I marked the section of covering that I would have to remove. When you install the tail parts, you must remove covering; be careful not to weaken the parts by scoring the wood. If you pull the covering up against the blade edge, a single-edge razor blade works well. When

the parts are glued in, it is time for the elevator halves to be installed with CA hinges. The elevator halves require a joiner wire to be installed. Make sure that it is straight before you glue it into place.

FUSELAGE

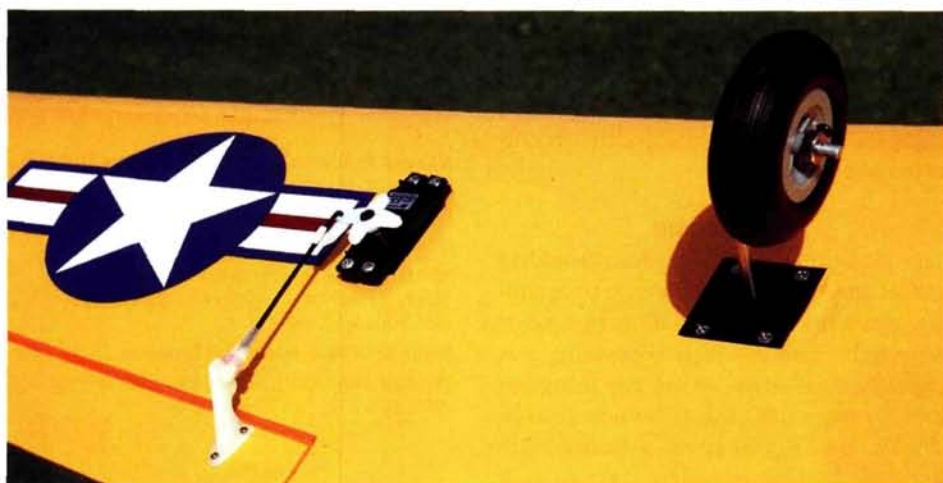
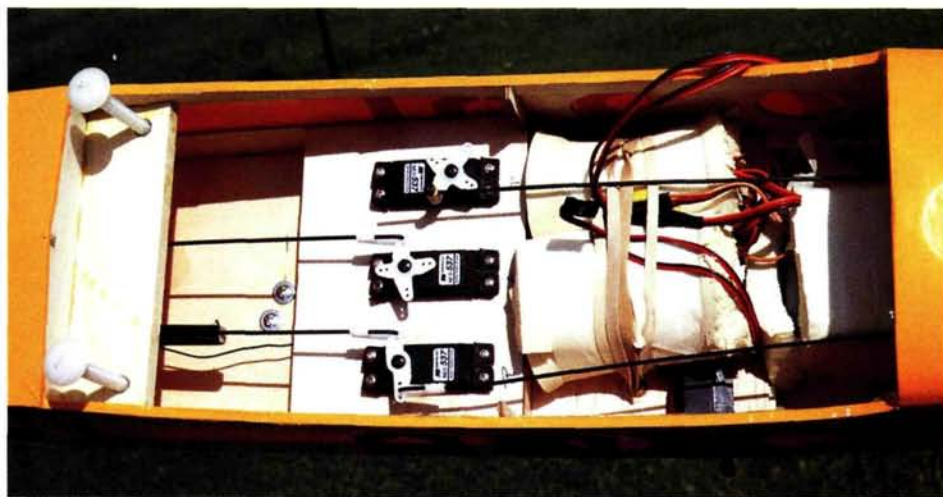
Now it is decision time: retracts or fixed gear. Thorough instructions are provided for both methods. I chose the fixed gear because I wanted to get the plane in the air sooner, but I think I will change it because I feel that the model looks a lot better in flight with the gear up. Be careful with the covering that needs to be removed. Instead of cutting out the entire wheel-well area, I cut the wing carefully so the fixed gear just fit. Pay particular attention to the nose; the covering is not fastened to anything in the cowl area. I ended up gluing a small piece of balsa to act as a filler strip for the covering to be ironed to.

- **Engine.** Next comes the engine installation. The instructions direct you to draw vertical and horizontal centerlines on the engine-mounting spacer. On my model, the lines were already marked, so this was unnecessary. The extensive

engine-mounting instructions will help people who have not done this type of airplane before. I tend to deviate from the instructions when I attach the engine to the engine mounts. I always use bolts and locknuts rather than sheet-metal screws. This is just my preference. When I drill the mounts, I always use a drill press to ensure that the holes are perfectly straight. The instructions only show how to mount a 2-stroke engine, and I feel that is a shortcoming of most manufacturers. As I was using a Saito .65 4-stroke, I had to rely on past experience to know what to do. A hole has to be drilled in the firewall for the throttle pushrod. Going through the firewall isn't a problem, but because there is a bulkhead that must be drilled as well, I used a long drill bit for this.

Next, I assembled the supplied fuel tank. Then I wrapped the tank in foam and slid it into the tank compartment; it was a tight fit but went in OK with a little persuasion. My advice: use thin foam.

- **Radio gear.** Following the step-by-step instructions, I installed the radio gear in the T-34's spacious fuselage. I then proceeded to install the JR 537 standard BB servos. Once this was done, the elevator



Above left: the radio compartment is cavernous, and the generous hardware package includes all the pushrod material and linkages. **Left:** each aileron has its own servo on the underside of the wing. The T-34 comes with fixed gear, and full retracts are available. **Above:** the rudder is actuated by a torque rod that's embedded in the tail section. It functions just as many aileron torque-rod setups, but it has been turned 90 degrees so that it's vertical.

When the T-34 was set up at the field, it drew many favorable comments, especially from the veterans who served in the early '60s. I ran a few tanks of fuel through the engine and did a range check. When all was in order, we were ready to go!

TAKEOFF AND LANDING

With its trike-gear configuration, the T-34 handles well during taxiing and the takeoff roll. My Saito was set a little on the rich side (it was still breaking in), and I was surprised how short the takeoff roll was. After about 65 feet, the Mentor leapt into the air. After a couple of passes around the field, I made some minor trim corrections; it needed a little up-elevator and some left aileron. I figure the up-trim can be attributed to its slightly nose-heavy condition.



and rudder pushrods had to be assembled by threading nylon clevises onto the supplied pushrods. Mount the control horns to the control surfaces just as you did before, with 90-degree bends and the supplied links. I attached the throttle linkage with a screw-lock connector at the servo. Next, I wrapped the receiver and battery in foam and mounted them in front of the servo tray. I secured them with two small cup hooks and rubber bands. As for the receiver antenna, I installed a short piece of fuel tubing at the rear of the fuselage and routed the antenna out through it.

• **Cowl and canopy.** The cowl is the next item to be installed. The instructions for this step are really good. Using cardstock, I was able to mark where the holes needed to be cut in the cowl to clear the Saito. Once all the holes are cut, the mounting-screw holes can be drilled. The canopy and decals are next. On the canopy, the painting was already done, so I only had to mount it. Before I glued it with canopy glue, I applied the instrument panel decals and installed a couple of pilot figures for a little extra realism.

The only remaining steps were to balance the plane and set its control throws. With the way I had everything set up, the airplane balanced slightly nose-heavy. If I

The Mentor has a fairly clean design, and when you reduce throttle, it takes a little longer to slow than most planes. For the first few flights, start your approaches farther out so you can get a feel for slowing the plane down. During the first landing, there was hardly any wind to help it slow down. Subsequent landings with a little wind helped the T-34 slow down nicely. The model makes great landings on the main gear, and it's easy to hold the nose up until most of the speed has been bled off.

LOW-SPEED PERFORMANCE

At low speeds, the T-34's control authority is good. During stall tests, the plane would get to a high angle of attack before it fell off easily to one side. Just adding power gets the Mentor flying very quickly, and I didn't notice any snapping tendencies.

HIGH-SPEED PERFORMANCE

The T-34 handles very well at high speeds and grooves right along. Control response is very positive, and I needed to dial down the high rates slightly to suit my flying style. No low rates are given in the manual, so I used 50 percent of the high rates as a starting point, and that worked well. I didn't notice any instability in high-speed maneuvers, and the transition from low to high speed required no trim changes.

AEROBATICS

Like its full-size brother, this model is very smooth and highly aerobatic. The plane flies very neutral and will do all scale-like maneuvers with ease. Basic maneuvers such as loops and rolls are graceful. The Mentor holds inverted with some down-elevator, and shifting the CG aft will help reduce how much elevator it needs. All in all, the T-34 Mentor is a great-looking, easy-to-fly warbird.



had moved the battery behind the servos, I think it would have been perfect. I chose to leave it the way it was for the initial flight test. The control throws had to be tamed a little to achieve the recommended settings.

CONCLUSION

The Hangar 9 T-34 is a sharp-looking model that requires little effort to assemble. It is well constructed; all its glue joints were tight, and the factory covering was expertly done—two of the key things to look for in an ARF. The T-34 looks great in the air, too. If you know someone who flew one of these legendary trainers, or if

you're just after that nostalgic military look, I recommend that you grab a Hangar 9 T-34 Mentor. I think you will like it as much as I do. ✚

Hangar 9; distributed by Horizon Hobby Inc.

Horizon Hobby Inc. (800) 338-4639; horizonhobby.com.

JR; distributed by Horizon Hobby Inc.

Master Airscrew; distributed by Windsor Propeller Co. (916) 631-8385; masterairscrew.com.

Saito; distributed by Horizon Hobby Inc.

Wildcat Fuels (859) 885-5619; orders only (888) 815-7575; wildcatfuel.com.



THUNDER TIGER

3D Spirit

BY AL
HARRIS



Catch the 3D spirit!

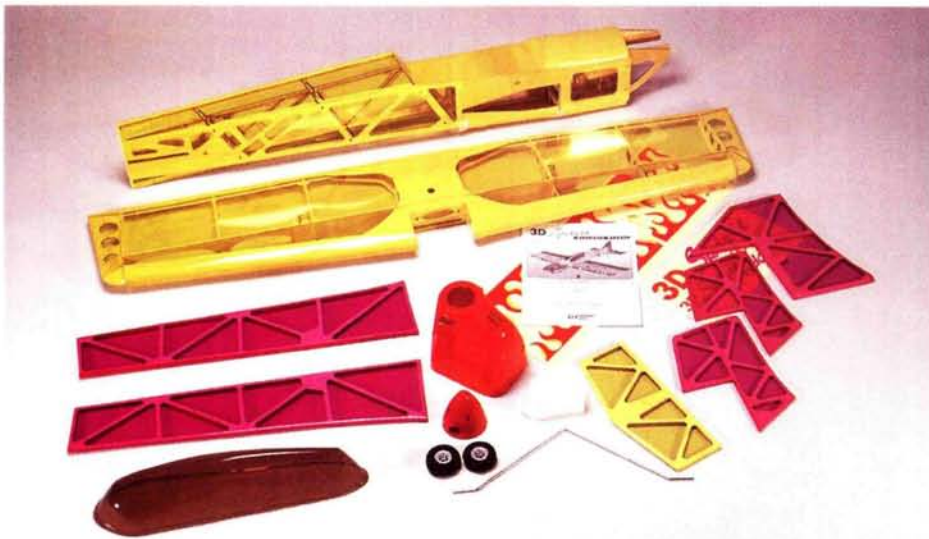
These are exciting times for 3D aerobatics. Never have there been so many 3D-capable airplanes to choose from. Thunder Tiger's 3D Spirit is the latest almost-ready-to-fly (ARF) model to join the 3D ranks. It has many features that enhance its flight performance, including oversize, counter-balanced control surfaces for quick maneuvering and lightweight construction for an optimum power-to-weight ratio. The elevators use a unique push-pull setup for positive control authority, which eliminates the need for a servo on each elevator half.

KIT CONTENTS

The fuselage, wing, tail feathers and control surfaces are built and covered with transparent Ultracote. The one-piece wing features a thick, symmetrical airfoil for great all-around flight performance. The fiberglass cowl is painted, and the kit also includes wire landing gear, a spinner, wheels, a fuel tank, a smoked canopy and flame-style decals. The high-quality hardware includes just about everything you'll need to assemble the 3D Spirit.

ASSEMBLY

Very little effort is required to get the Spirit in the air, and I was able to complete the assembly at a leisurely pace in three evenings. Major steps include mounting the engine and fuel tank, aligning and mounting the wing, gluing on the tail feathers and installing the radio system. You'll need a work surface large enough to accommodate the one-piece wing. The instructions are straightforward and easy to understand.



• **Wing.** I started assembly by mounting the wing on the fuselage and removing the covering from the servo bays and from the wing's center section for the servo extensions. A pair of dowels in the wing's center-section cutout that mates with a fuselage former and a single bolt into the rear securely hold the wing in place. For convenience, the wing-bolt blind nut should be installed in the plywood mounting plate before you insert the plate into the rear of the fuselage. After installing the blind nut and mounting plate, I aligned the wing by measuring equal distances from each wingtip to the rear of the fuselage. I then secured the wing so it couldn't move, drilled a hole in the rear of the wing and lined it up with the blind nut. After the wing had been bolted into place, I hinged the ailerons to it. I used a Great Planes Slot Machine to make the hinge slots and thin CA to

attach the hinges. I also hinged the elevators and cut hinge slots in the rudder.

FUSELAGE

I prepared the fuselage for the tail surfaces by removing the covering from the slots in which they would be installed. While I was at it, I also removed the covering where the servos are mounted. I aligned the stab assembly and glued it into place with epoxy.

Next, I trimmed the canopy and installed it with transparent tape. There's a recess in the bottom of the fuselage for the landing gear, and it's held in place with a couple of wood blocks and 5-minute epoxy. The recommended engine for the 3D Spirit is Thunder Tiger's Pro-46, which is what I used. I can't say enough good things about a nitro powerplant that starts with a flick of the wrist and performs like a perfectly tuned and well broken-in

favorite. I plumbed the fuel tank and installed it as shown in the instructions. I fit the cowl and made the necessary openings in it for the muffler, needle valve and cooling holes.



Top: for convenience, I made a large hole in the cowl for easy access to the needle valve and the fuel line. **Right:** no lack of space here! Only the throttle servo, the receiver and its battery are in the fuselage.



specifications

MODEL: 3D Spirit

MANUFACTURER: Thunder Tiger

DISTRIBUTOR: Ace Hobby Distributors

TYPE: 3D aerobat

WINGSPAN: 53 in.

WING AREA: 725 sq. in.

LENGTH: 57 in.

WEIGHT: 4.5 lb.

WING LOADING:
14.3 oz./sq. ft.

ENGINE REQ'D:
.46 to .50
2-stroke

ENGINE USED:
Thunder Tiger
Pro-46

RADIO REQ'D:
4-channel w/5
servos

RADIO USED:
Hitec Eclipse 7
w/4 Hitec
HS-525BB ser-
vos (ailerons [2],
elevator, rudder)
and 1 Hitec HS-
425BB (throttle)
servo

FUEL USED: Wildcat 15%

PROP USED: Thunder Tiger 11x5.5

PRICE: \$249.99

FEATURES: Iron-on transparent covering; all-wood airframe; one-piece wing; dual-linkage control system on elevators; counterbalanced control surfaces; fiberglass cowl; wheels; spinner; wire landing gear; hardware package; smoked canopy; fuel tank; flame decals; and instruction manual.

COMMENTS: the 3D Spirit is an amazing performer. The airframe is incredibly light and strong, and the transparent covering looks sharp. The high quality of the construction is very apparent, as you can see just about every glue joint through the covering. No hiding mistakes here! The plane is well suited to intermediate pilots who want to enter the world of 3D maneuvers and to advanced pilots looking for a medium-size 3D aerobat that's easy to transport and store.

HITS

- Very light.
- Spectacular performance.
- Attractive design and color scheme.
- Fast, easy assembly.

MISSES

- None.



The 3D Spirit will amaze you. The incredibly light airframe coupled with the Thunder Tiger Pro-46 engine allows the Spirit to do things I didn't think were possible with a plane of this size.

TAKEOFF AND LANDING

From a smooth surface, the 3D Spirit will take off in as little as 10 feet and has unlimited climb-out. It doesn't get any easier than that! Landings are a pleasure; the thick, symmetrical airfoil allows this bird to slow down nearly to a crawl. The large foam



tires combined with the flexible landing gear provide a nice cushioned landing.

LOW-SPEED PERFORMANCE

The Spirit's low wing loading makes it a joy to fly at low speeds. Again, the model's overall light weight and oversize control surfaces really enhance slow flight maneuvers. I estimate that the Spirit slows down to about 10 to 15mph without stalling. Half-throttle settings keep the Spirit at a comfortable speed with lots of power to spare.

HIGH-SPEED PERFORMANCE

The Thunder Tiger Pro-46 and the Thunder Tiger 11x5.5 prop get the Spirit moving. It's recommended, though, that you keep top speed down to prevent the control surfaces from fluttering.

3D AEROBATICS

This is where the Spirit really shines; it feels very predictable and comfortable in the air. Name a maneuver, and the Spirit can do it: vertical hovering, torque rolls, harriers, blenders, snaps and knife-edges are all within the model's capabilities. The roll rates are incredible; the rolls are very axial and require little, if any, elevator correction. With the Spirit's generous fuselage side area, knife-edge maneuvers are effortless, and I noted very little pitch coupling. A big advantage of a light model is its low inertia, which makes point rolls and reversals happen in the blink of an eye. I must say that I was very pleased with the 3D Spirit's aerobatic prowess.



The control setup for the elevators is really slick and works extremely well.



A small cutout for the muffler is needed in the cowl.

Thunder Tiger Pro-46

Thunder Tiger's Pro Series Pro-46 aircraft engine features full bearings throughout, a 2-needle valve carburetor and ABC construction. It was designed for the serious flier who is looking for performance, great quality and power. I found the Pro-46 to be a smooth-running engine. The Thunder Tiger Pro Series engine features the all-new, improved carburetor with the swept-back needle for an optimized air-fuel ratio, and it costs only \$99.



The hardest part of the assembly is putting the long, thin flame decals on the wing. I sprayed the wing with window cleaner, positioned the decals and carefully rubbed them into place.

FINAL ASSEMBLY

Radio installation is simple, as the model has plenty of room for the radio gear, and the component locations were well thought out. I started by installing the servos in the wing and fuselage and then added the control horns and pushrods. You'll need to add a 12-inch servo extension to the rudder, elevator and aileron servos. I installed the receiver and battery side by side in the wing-saddle area of the fuselage using Velcro®.

The elevator servo is mounted at a 45-degree angle in the fuselage and uses a push-pull arrangement to a torque tube that passes through the fuselage. The left elevator pushrod is then connected to the torque tube's bellcrank, and the right pushrod is connected to the torque tube via

a bellcrank on the other side of the fuselage. This arrangement makes for a very tight, slop-free control system with straight pushrod runs. Another advantage is that you need only one servo for the elevator.

Final details include balancing the model, setting up the control throws and double-checking all systems.

BUILDER'S FINAL THOUGHTS

The 3D Spirit is one of the best-performing planes I have ever flown. Short takeoffs, enough power to hover and climb vertically and control surfaces large enough for radical maneuvers all help to make the 3D Spirit a real blast to fly! If I could have only one sport plane, the 3D Spirit would be my choice. ✚

Great Planes (217) 398-6300; (800) 682-8948; greatplanes.com.

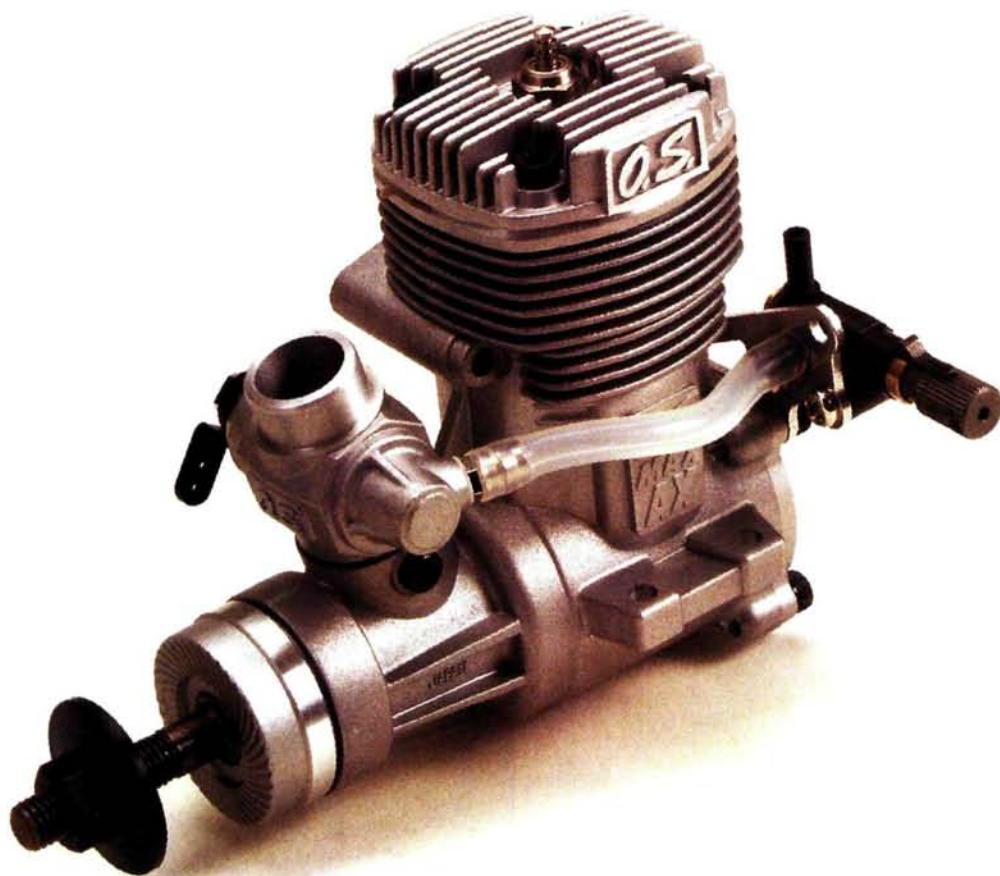
Hitec RCD (858) 748-6948; hitecrd.com.

Thunder Tiger; distributed by Ace Hobby Distributors (949) 833-0088; acehobby.com.

Wildcat Fuels (859) 885-5619; orders only (888) 815-7575; wildcatfuel.com.

O.S. MAX .46AX

A CLASSIC POWERPLANT—**NOW EVEN BETTER** by C. David Gierke

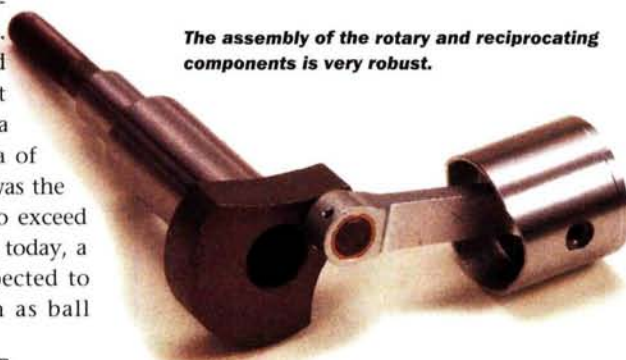


Longtime *Model Airplane News* contributor Andy Lennon says, "The O.S. Max .46 is the best engine I've ever owned." He should know; Andy has designed and built many successful models around the venerable .46, including the Crow, Sea Hawk, Seagull III, Robin, Swift and Wild Goose.

Over the years, there have been many iterations of the Max .46, but its roots can be traced to the then revolutionary O.S. 40F-SR of 1976. This new design featured Schnuerle porting, front rotary-valve induction and a side exhaust. During this era of small pattern ships, the F-SR was the first .40-size pattern engine to exceed the 1hp barrier. Back then, as today, a high-quality engine was expected to have certain features, such as ball

bearings for crankshaft support and bronze bushings for the connecting rod, but quality wasn't always enough: pilots constantly demanded better performance. Hard-pressed, manufacturers met the horsepower challenge by increasing the .40's displacement by 15 percent without significantly increasing its physical size or weight. Enter the first O.S. .46. Sales showed that the new engine was an instant hit, and even competitors agreed. RC pattern and scale pilots

The assembly of the rotary and reciprocating components is very robust.



ENGINE HIGHLIGHTS

- Ideal for sport, pattern and scale planes
- Super-easy starting and break in
- Plenty of power—1.23hp!
- Exceptional parts quality
- Rear-mounted needle valve for easy, safe adjustments

specifications

ENGINE: O.S. Max .46AX

DISTRIBUTOR: Great Planes Model Distributors Co.

DISPLACEMENT: 0.455ci

BORE: 0.866 in.

STROKE: 0.772 in.

CONNECTING-ROD LENGTH: 1.361 in.

CONROD/STROKE: 1.76:1

INDUCTION TIMING: open—34° ABDC; close—52° ATDC; duration—198°

TRANSFER TIMING: open—60° BBDC; close—60° ABDC; duration—120°

BOOST TIMING: open—55° BBDC; close—55° ABDC; duration—110°

EXHAUST TIMING: open—72° BBDC; close—72° ABDC; duration—144°

COMPRESSION RATIO (EFFECTIVE): 9.62:1

GLOW PLUG: O.S. no. 3 (short)

SHAFT NOSE THREAD: 1/4x28

CARBURETOR TYPE: fuel metering; 2-needle

CARBURETOR CHOKE BORE: 0.308 in.

TEST FUEL: Cooper's Custom Blended Fuels—10% nitromethane, 20% oil (16% synthetic, 4% castor)

WEIGHT WITH MUFFLER: 17.22 oz.

PRICE: \$115

FEATURES: front intake, side exhaust, remote primary needle valve, fuel-metering 2-needle carburetor, twin ball-bearing crankshaft, 4-machine-screw cylinder-head attachment, ABL (advanced bimetallic liner) cylinder sleeve, Schnuerle with boost porting, asymmetrical crankshaft balancing.

KEY

- ABDC = after bottom dead center
- ATDC = after top dead center
- BBDC = before bottom dead center

were joined by hordes of sport modelers who valued the power and user-friendliness of the new .46. Momentum from its early triumphs has carried the .46 more than 25 years to the present, where it continues to thrive within the extensive O.S. engine line.

A CLOSER LOOK

The latest model, the .46AX, replaces the popular .46FX. Many features remain, however: the mounting-bolt pattern, dual ball

"The cylinder liner is still ABL, but a new design helps align and level the head to ensure a perfect seal. And the head still snugs down with [machine] screws ... but there are only four, instead of six."

The new front-intake, side-exhaust, twin-ball-bearing O.S. is conventional in design and follows the successes of previous engines of this displacement. Its die-cast, one-piece aluminum-alloy crankcase has a

... the O.S. Max 46AX proved to be a very user-friendly engine.

fuel-metering carburetor as well as a remote primary needle valve. The drive washer is "keyed" onto the crankshaft, eliminating the previous removal problem associated with collet-lock assemblies.

DESIGN FEATURES

After I had disassembled the .46AX, my customary measurement of component parts (sizes and clearances) and design particulars revealed several interesting features:

■ **Connecting rod.** The engine's relatively low connecting-rod-to-stroke ratio (1.76:1) indicated that the design was intended for low nitromethane-content



The bronze-bushed connecting rod maintains very accurate clearances to the wristpin and crankpin.

fuel blends (see "The connecting rod and nitro content" click trip). Also, its effective compression ratio turned out to be quite high—9.6:1 (see the "Geometric and effective compression ratio" click trip)—further reinforcing the low nitro requirement. Why? Methyl alcohol



The asymmetrically balanced crankshaft web is designed to offset the material removed from the radial induction hole.

bearings and the advanced bimetallic liner (ABL) cylinder sleeve. Although the cylinder sleeve (liner) has retained its "drop-in" configuration, engineers at O.S. advertise that



The shallow groove below the piston dome is intended to retain lubricating oil. The AX has two music-wire wristpin retention clips.

MEASURING PEAK POWER

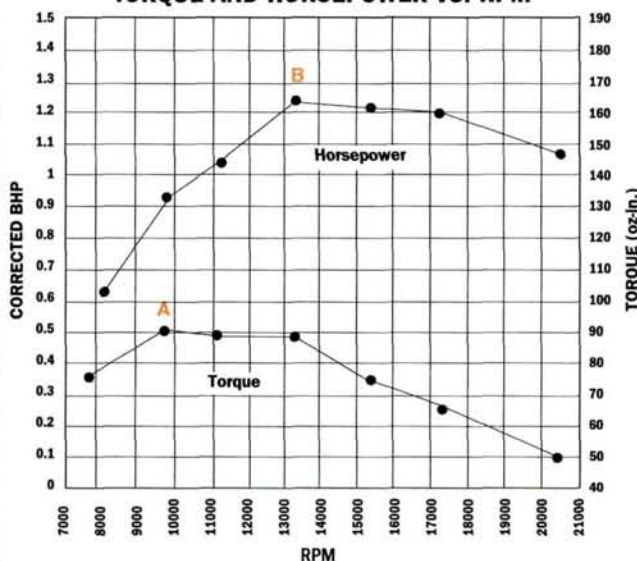
TORQUE

In the "Torque and horsepower vs. rpm" graph (right), note that the engine was tested at shaft speeds ranging from 7,900 to 20,500rpm. Although peak torque occurs at 9,800rpm, notice that the curve is flat between 9,800 and 13,200rpm. This is good news for those desiring to prop their engines for torque; all of the APC propellers tested (except the 12x8) fall within this region.

HORSEPOWER

Maximum brake (measured) horsepower occurs at 13,200rpm but also remains flat through 17,300rpm. Although I didn't test-fly propellers that would load the engine within this range, I estimate that an APC 10x6, 10x7, 9.5x7, 9.5x8 and 9x9 would allow elevated shaft speeds, thus taking advantage of the engine's power characteristics. Small propellers such as these, however, can only be used successfully in lightweight, low-drag models designed for high-speed applications.

TORQUE AND HORSEPOWER VS. RPM



Engine dynamometer testing revealed a peak torque of 90 oz.-in. @ 9,800rpm (A) and a peak horsepower of 1.23 bhp @ 13,200rpm (B).

Temp.: 72 deg. F
Barometer: 29.01 in. Hg.
Wet-bulb temp.: 63 deg. F
Bhp correction factor: 1.06

PROP RPM

Size*	Rpm
11x5	13,150
11x6	12,800
11x7	12,000
12x6	10,800
11x8	10,500
12x7	10,000
12x8	8,800

▶ Best horsepower

▶ Best torque

*APC props used in test.

O.S. MAX .46AX

(methanol) tolerates high compression ratios much better than nitromethane, which tends to detonate. Detonation is characterized by a frying-egg sound and sharply elevated cylinder-head temperatures; if allowed to continue, detonation can destroy an engine by melting a hole through the piston crown. Increasing the fuel's nitro content will often boost the engine's torque and power, but the possibility of detonation also increases. As stated in the owner's manual, 10- to 15-percent nitro (by volume) is about the limit for the .46AX.

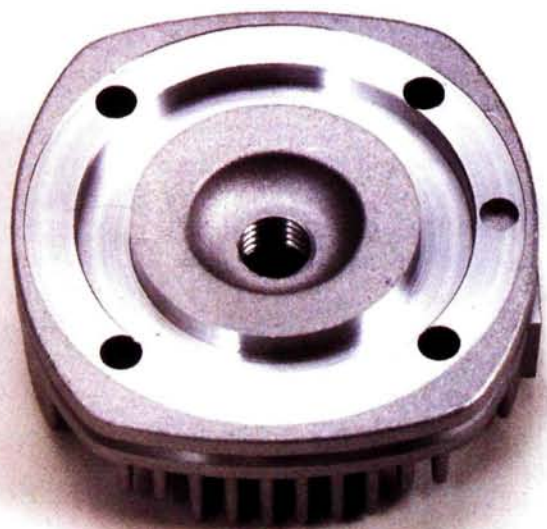


View of the brass cylinder sleeve showing the exhaust ports.

■ **Porting system.** The O.S. cylinder-porting system uses the tried-and-true combination of two Schnuerle transfer ports and a single boost port. A subtle but significant departure from established practice is seen where the descending piston opens the Schnuerle transfers slightly before the boost port. This strategy requires a portion of the boost port's energy flow to redirect the primary air/fuel mixture streams toward the squish-band portion of the cylinder head, away from the glow-plug element. In the early years of Schnuerle boost-port systems (late 1960s), this arrangement was featured with notable success. As time went on, designers began using the boost port more as a transfer port, rather than a control port, by opening it simultaneously with the primary Schnuerle ports; unfortunately, plug quenching during idle and throttle-up became more of a problem. I, for one, welcome O.S.'s return to an earlier paradigm!

■ **Crankshaft.** A prominent feature of the .46AX is its massive crankshaft counterbalance. When viewed from the rear, the crank web is seen to be asymmetrical and over-balanced to the trailing side. Although a single-cylinder engine can't be perfectly balanced (there will always be speeds at which it shakes worse than others), O.S.'s engineers have compensated for the radial induction-hole cutout (below the carburetor) that was largely ignored in past designs. Testing has demonstrated very smooth operation throughout the engine's practical speed range. The crank's relatively small axial induction hole (0.395 inch) suggests that increased mixture velocities lead to superior crankcase filling and scavenging (clearing) into the engine's combustion zone.

■ **Carburetor.** The twin-needle-valve (40G) carburetor has a relatively small choke diameter of 0.308 inch. The thermoplastic primary needle-valve body is attached to the nickel-plated, stamped-steel bracket with self-tapping screws. The bracket is designed to allow vertical or horizontal needle-valve positioning, depending on the

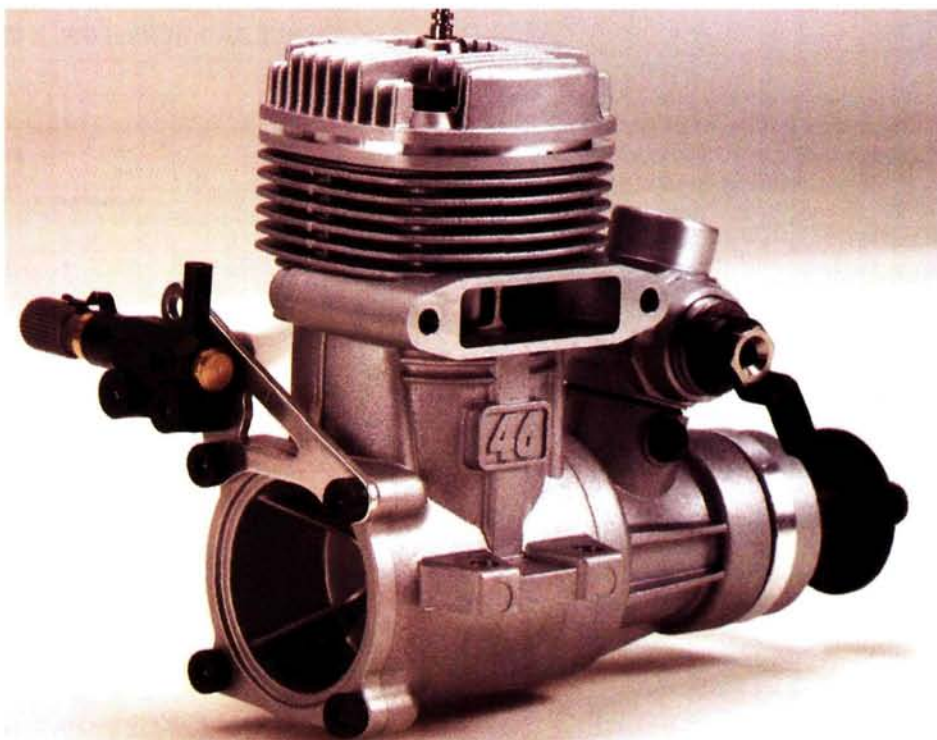


The squish band, hemispherical head with deep recess for cylinder sleeve flange seat.

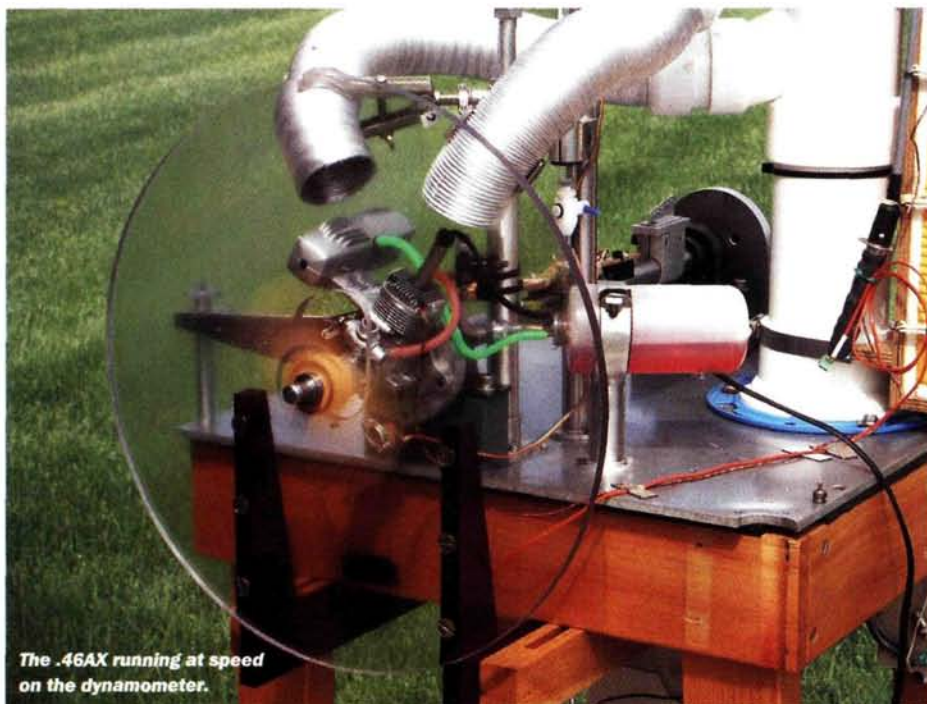
mounting holes selected. The bracket is mounted on the engine's rear cover by two machine screws. The needle valve is sealed to its brass insert with a single O-ring and retained in the desired position by a plated spring-steel ratchet clip. The inlet and outlet nipples are sized for medium fuel tubing.

BREAK-IN AND TESTING

Although the instructions recommend running the engine rich (4-cycling) during the break-in period, I used the preferred method for all ABC-type engines: run it at a fast 2-cycle (several hundred rpm less



Notice the two-position primary needle-valve bracket. The .46AX is a very sturdy design.



The .46AX running at speed on the dynamometer.

than peak) with a low-load propeller about 1 inch smaller in diameter than a recommended flight prop. I ran the .46AX for 2-minute periods on the fuel that was intended for flight. I then shut it down and allowed it to cool to the touch before restarting. The total break-in lasted 20 minutes, at which time I decided the

engine was ready for propeller rpm analysis (see the "APC propeller rpm" chart).

The engine's sound level was 91 decibels ("A" scale) at 9 feet while using an APC 12x7 propeller. The engine throttled to a reliable 2,200rpm with a crisp return to the wide-open position; there was no tendency to richen or lean out with the factory-set

low-speed needle valve. During break-in and propeller testing, I noticed that the joint between the front and rear sections of the muffler was leaking liquid exhaust products (primarily waste oil); this creates a mess that eventually burns onto the surface of the muffler and is very unsightly. The muffler joint needs a gasket to prevent this from occurring.

SUMMING UP

Overall, the O.S. Max .46AX proved to be a very user-friendly engine. Its design, materials and machining are impressive. The .46AX turns an APC 12x7 propeller about 800rpm faster than its ringed FX predecessor with excellent low-rpm torque. Andy Lennon will be proud! ✦



FOR BONUS
ENGINE INFO

APC; distributed by Landing Products (530) 661-0399; apcprop.com.

Cooper's Custom Blended Fuels; 226 Robertson Ave., Battle Creek, MI 49015. O.S.; distributed by Great Planes Model Distributors (217) 398-6300; (800) 682-8948; osengines.com.

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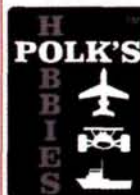
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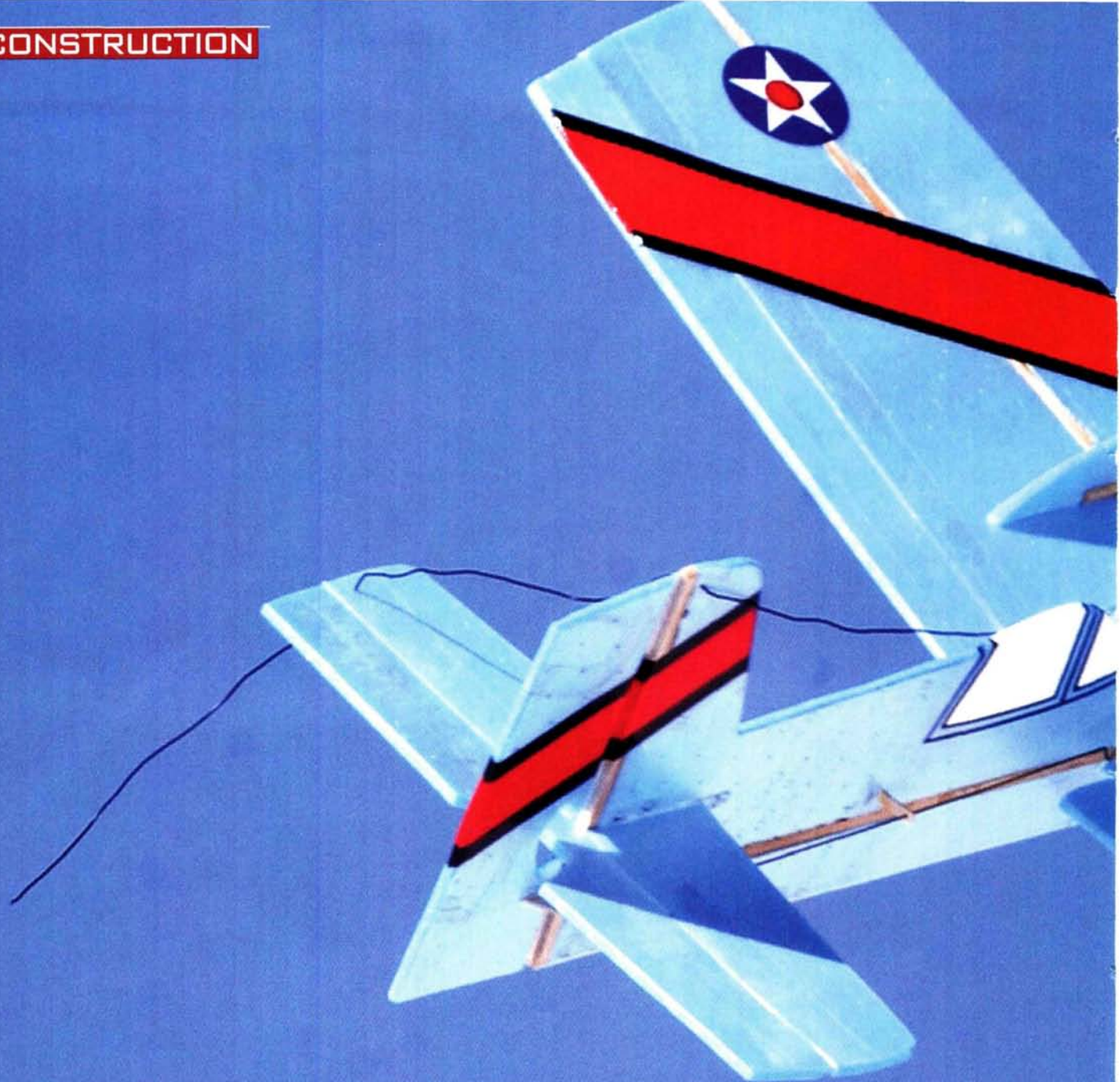
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1 servo



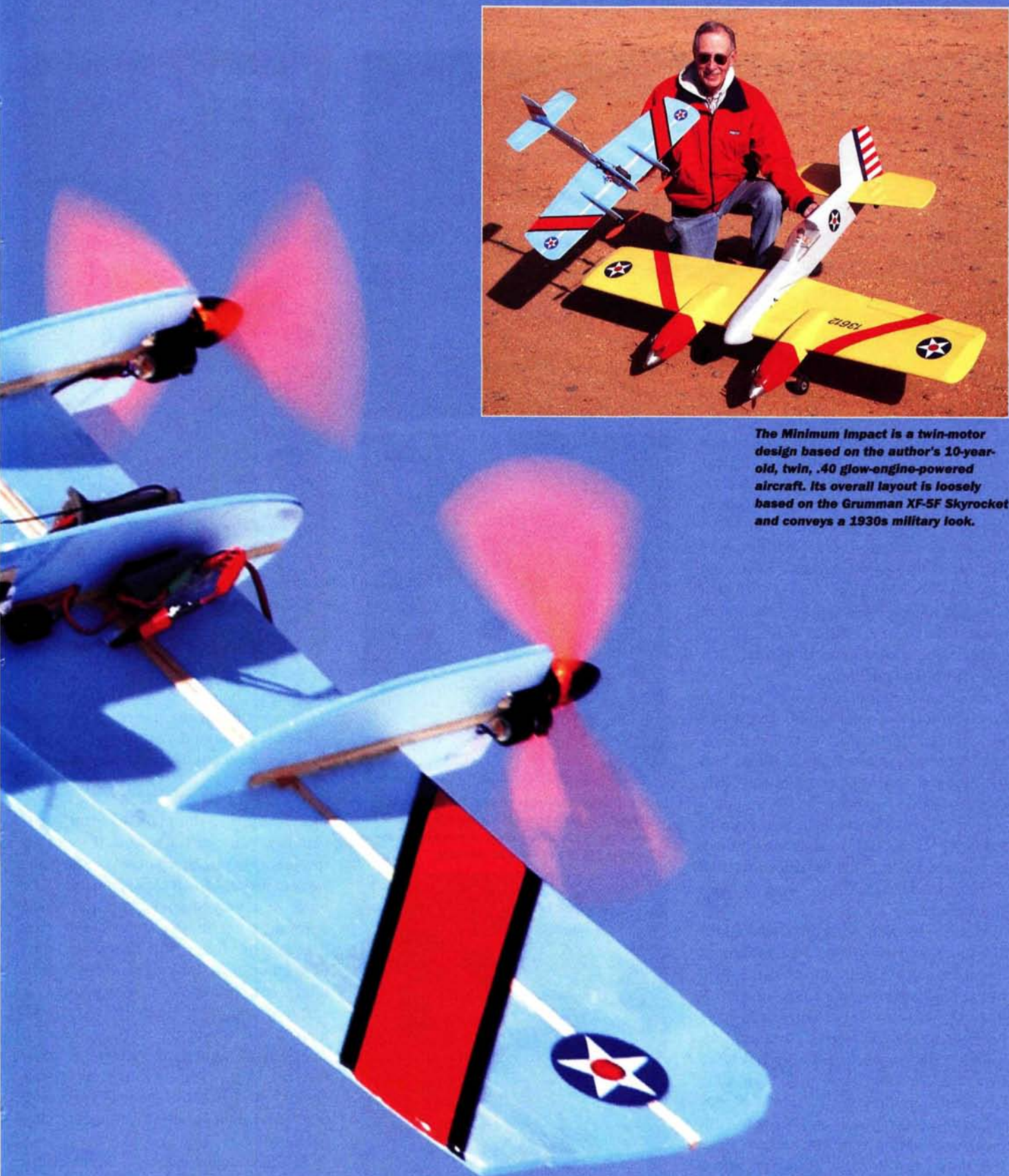
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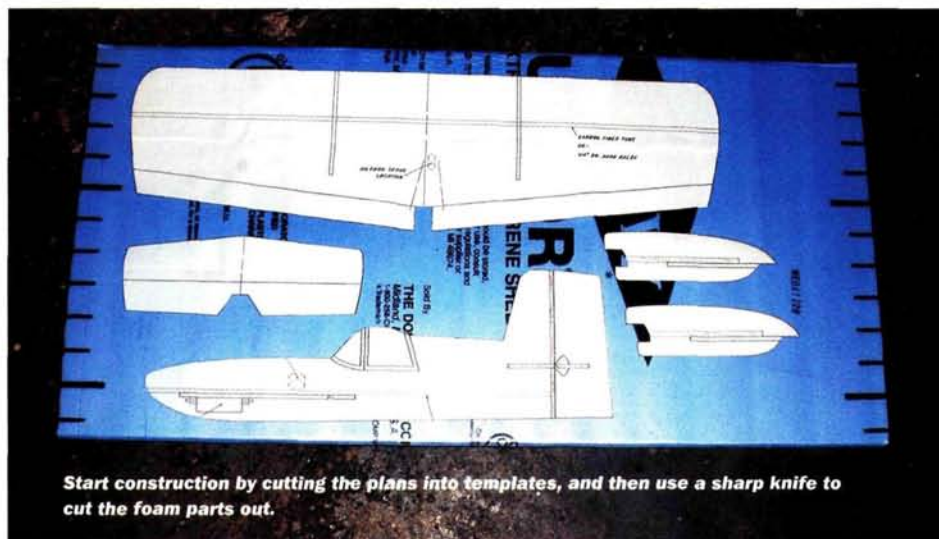
by Dick Sarpolus **Minimum**
IMPACT



The Minimum Impact is a twin-motor design based on the author's 10-year-old, twin, .40 glow-engine-powered aircraft. Its overall layout is loosely based on the Grumman XF-5F Skyrocket and conveys a 1930s military look.

An inexpensive twin electric that delivers maximum fun!

The first twin-engine model I owned was powered by a Fox .35 and a Fox .29; yes, it was a control-line stunter, and I flew it in the 1953 AMA Nationals in Willow Grove, PA. Since then, I've designed a number of twins with power ranging from a pair of .19 glow engines to a pair of 42cc gas burners. All of them were fun because of that unmistakable twin-engine sound.

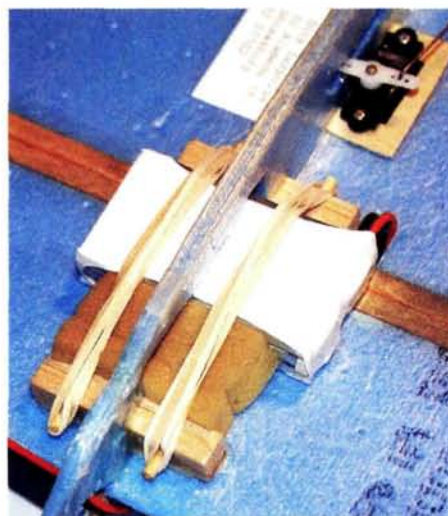


Electric-powered aircraft have made it easier for everyone to build twin-motor projects; unlike glow engines, electric motors just keep on running as long as there is power available. I wanted a smaller, electric-powered profile foamie version of one of my favorite twins: the .40-powered Double Impact that I designed several years ago. The Minimum Impact is the result, and although it's smaller and a lot quieter than any other twin, it's just as much fun.

The construction technique used for this project is the quickest and easiest way to make an RC aircraft that I know of. Material costs are absolutely minimal, and the model is very light and flies very well. Profile models have been well accepted over the years and now have their place in modeling. It can take some abuse and can be repaired quickly. If you happen to total it, hey; it sure doesn't take long to build another one.

With a 36-inch wingspan and about 320 square inches of wing area, Minimum Impact is fairly small. For power, I used two GWS IPS twin-motor units—the IPSD-RXC-AS versions. These units each have two motors geared to one prop shaft. I fitted each motor with the optional GWS heat sink for extra protection. I'm a big fan of lithium-polymer batteries, as they provide so much power and are very light compared with any other battery type. The all-up weight of the prototype with a 3-cell, 1500mAh pack is only 16 ounces. I use APC 9x7 props, but I want to do more experimenting with prop sizes; for now, however, flight performance is good. The GWS brushed motors are inexpensive, and if there were a brushless equivalent in this size, two would make the plane a real barn-burner.

I built the model with Dow Bluecor extruded-polystyrene FanFold sheet.



Above: this bottom view shows the 3-cell, 1500mAh Li-poly battery pack held in place with several rubber bands. **Below:** the aileron servo is installed in the bottom of the wing.



Available at home-improvement stores, this 1/4-inch-thick, blue material is used for house insulation, and it has a thin, plastic-film layer on each side. It is available in 25-count bundles of 24x48-inch sheets for about \$30. The materials cost for one model is about a buck; you can't beat that!

specifications

MODEL: Minimum Impact

TYPE: twin electric

WINGSPAN: 36 in.

WING AREA: 320 sq. in.

WEIGHT: 16 oz.

WING LOADING: 7 oz./sq. ft.

LENGTH: 29 in.

POWER SYSTEM:
2 GWS IPSD-RXC-AS motors w/10A ESC

BATTERY USED: 3-cell, 1500mAh Li-poly pack

PROP USED: APC 9x7

RADIO REQ'D: 4-channel (rudder, elevator, throttle, ailerons)

COMMENTS: designed by Dick Sarpolus, the Minimum Impact is built using inexpensive Dow FanFold blue foam sheet. Hard balsa or carbon-fiber tube reinforcement can be used as shown on the plans.

As shown on the plans, I used hard, 1/4-inch-square balsa strips for reinforcement, but I recommend the use of carbon-fiber tubes for increased stiffness. They cost more but make the airframe more rugged.

CONSTRUCTION

Start by cutting the plans to form paper patterns; you can trace around them on the foam or pin the patterns into place and cut around them. A single-edge razor blade or a very sharp hobby knife held perpendicular to the sheet easily cuts through the foam. Cut the wing to fit the carbon-fiber tube or hard-balsa reinforcement, and epoxy it into place. It is easier if you first epoxy the reinforcement to the top of the fuselage, epoxy it to the wing and then epoxy the lower fuselage into place. After the epoxy has cured, glue the horizontal stab into place, and then epoxy the motor nacelles to the wing.

Before you glue the wing and horizontal stab to the fuselage, hinge the ailerons and the elevator into place. I use clear, thin, low-cost, packing tape for the hinges. Attach the tape to the top surfaces first, and then fold the movable control surface over to apply the bottom piece of tape.

I made the control horns out of 1/16-inch plywood and epoxied them into slots cut in the control surfaces. To install

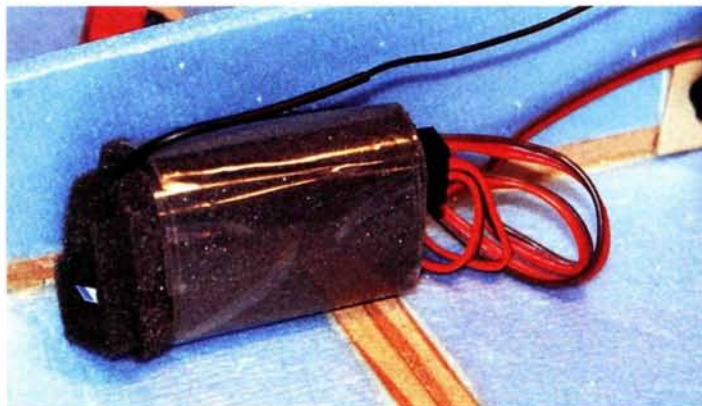
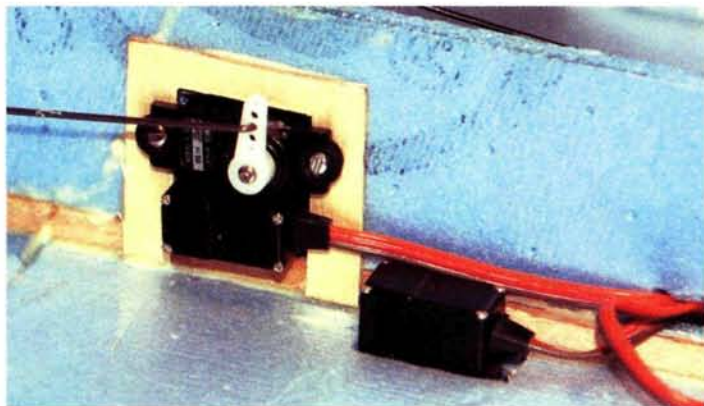


flight performance

This twin has enough power for loops, rolls, inverted flight and other easy aerobatic maneuvers. Vertical performance is limited, and it definitely isn't a 3D machine. It can fly in reasonably windy conditions, but for starters, choose a calm day. With twin props going and such an unusual planform, the model looks really good doing low-level, high-speed passes. With its flat-plate wing, Minimum Impact isn't a floater but it can easily be brought in exactly where you want it. In low-speed flight, the model remains responsive and is easily controlled.

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the servos with small screws, I epoxied small pieces of $\frac{1}{16}$ -inch plywood to the foam on either side of the servo cutouts. For the lightest possible weight, some builders simply cut holes in the foam and hold the servos in place with Goop or hot glue. I installed the aileron servo in the wing next to the fuselage and cut a small slot through the fuselage to allow the servo arm and control linkage to reach the other aileron. To make the wire pushrods, I use 0.047-inch music wire and make Z-bends on each end. I use a V-bend near the servo for length adjustment. To support the middle of the two pushrods, I glued small plywood braces into slots cut in the fuselage.

POWER SYSTEMS

I got all of my GWS products from Balsa Products. The motor/gearbox assemblies slide into place on a strip of hard balsa or pine in each motor nacelle. Sand the strips to fit the gearbox frames. I drill a small hole through the side of the gearbox mounts and hold the motors in place with small screws. I wrap the ESC and the receiver with thin foam and clear tape and hold them in place with Velcro®. The battery pack fits through an opening cut in the fuselage just below the wing. The ESC, receiver and pack are held in place with rubber bands. Two pieces of $\frac{3}{8}$ -inch-square balsa, each fitted with two short lengths of $\frac{1}{8}$ -inch dowel, are epoxied to

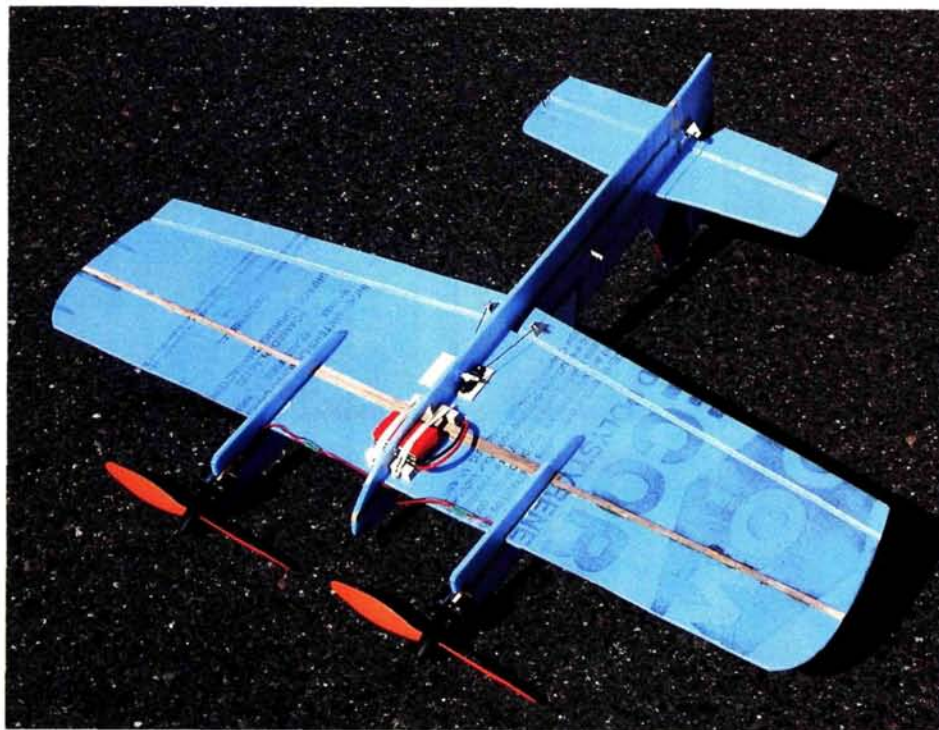


Above left: the elevator and rudder servos are installed in the fuselage. Wire pushrods run back to the elevator and rudder surfaces. **Above right:** the receiver and ESC are held with Velcro®.

Left: the control horns are made of $\frac{1}{16}$ -inch plywood epoxied into slots cut in the control surfaces.

Below: although the overall layout may not be optimal for aerobatics, there's plenty of wing area and large ailerons, rudder and elevator surfaces, so the plane allows plenty of fun aerobatic flying. It isn't a 3D flyer, but low passes with those twin motors humming are impressive.





Above: the blue FanFold foam offers a very low-cost, quick and easy profile construction that produces a light, good performer. The foam can be spray-painted with water-based craft paint. Low-temperature iron-on film trim and covering can also be used. **Left:** this close-up view shows one of the GWS IPS twin-motor power units. Two small motors are geared together to turn the 9x7 prop with a 3.5:1 ratio. The finned heat sinks are optional.

the wing to anchor the rubber bands.

That's it! All that's left to do is charge your batteries and check your radio system to make sure that everything works properly. What are you waiting for? Let's head to the flying field!

When you hand-launch it, the Minimum Impact flies easily out of your hand; you can launch it overhand or underhand. The model has plenty of power, performs well and can do sporty aerobatics. It's quiet, of course, but a bit of that twin-engine sound is still there to add to the fun. And you don't ever have to worry about one motor stopping before the other one! Enjoy! ✚

APC Props; distributed by Landing Products (530) 661-0399; apcprop.com.

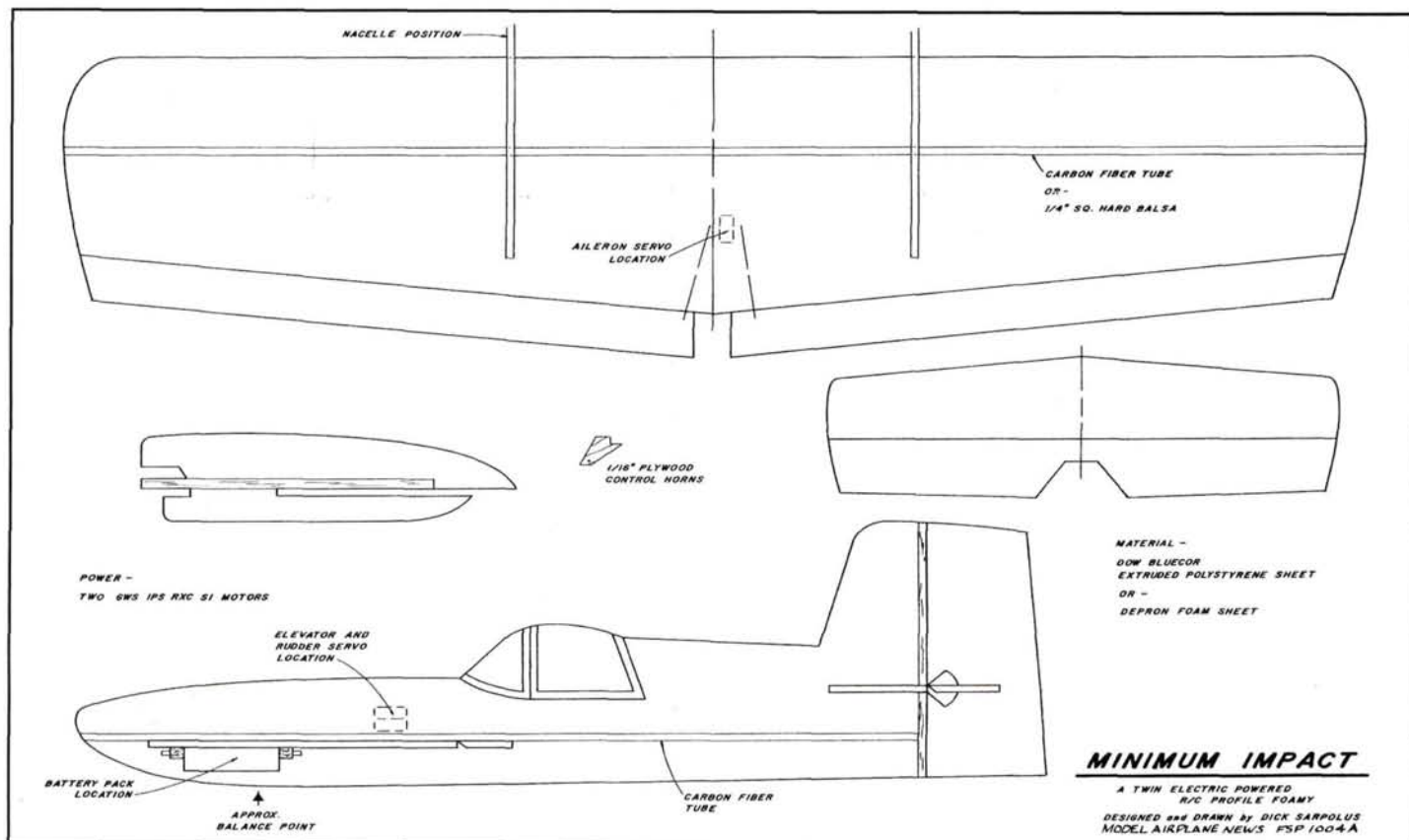
Balsa Products (732) 634-6131; balsapr.com.

GWS USA (909) 594-4979; gws.com.tw.

MINIMUM IMPACT FSP1004A

Designed by Dick Sarpolus, the Minimum Impact is an aerobatic twin-motor sport flyer. It is built using inexpensive Dow FanFold blue foam sheet. Hard balsa or carbon-fiber tube reinforcement can be used as shown on the plans. Two inexpensive GWS power systems are used to power the model and provide spirited—but not unlimited—performance.

WS: 36 in.; L: 29 in.; power: 2 geared motor systems; radio: 4-channel; 1 sheet; LD 2. **\$19.95**



Homemade canopies

Vacuum-formed canopies are a must-have for many warbirds and modern-day aircraft models. In a kit, the formed canopy is a factory-made part that comes as part of the package. But when scratch-building a scale model, you must make your own. Sometimes for popular designs, specialty companies and/or designers of published plans offer formed canopies, but more often than not, the scratch-builder is faced with the task of "growing his own." Here's how it's done!

TYPES OF CANOPIES

There are two basic types of canopies: the flat-sheet plastic type that's either bent or folded into shape, and the more complicated, teardrop-shape canopy that's used on many warbirds and modern sport aircraft. The teardrop canopy requires the plastic to be heated and then formed over a plug or male mold with a vacuum to pull it into place.

PLUG BASICS

The quality of a canopy stands or falls with the quality of the plug you use to form it. To produce a really good-quality canopy, your plug has to be as perfect as possible. Plugs can be formed in several ways, including the methods that I described in my "How to make fiber-glass parts" article in the March 2001 issue of *Model Airplane News*.

The canopy's shape and size must be accurate because it is one of the most noticeable parts of a model; any deviations will immediately make your model look out of proportion and spoil its good looks. Start by enlarging various scale views of your subject aircraft to the actual size of your model, and check them against one another to see which is most accurate. You can also enlarge a profile photo of the full-size aircraft and check it against the drawings.

By adding a spacer piece to its bottom, make the



One of the more challenging tasks for modelers who scratch-build is forming their own canopies. This column explains how to do it!

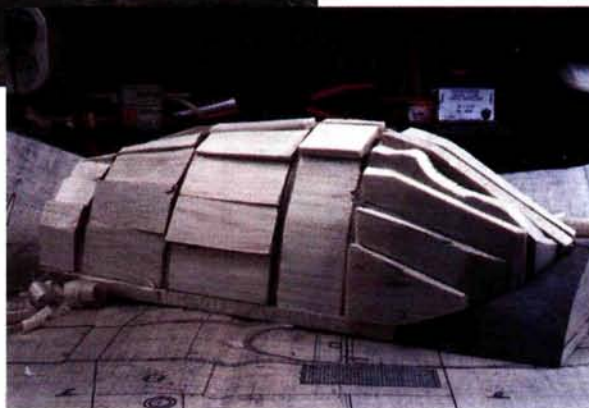
plug about 1/2 inch higher than the canopy you're making. This is because, as it is formed, the plastic sheet will form a radius at the bottom corners of the plug. The size of this radius depends on the type and thickness of the plastic you are using and how much vacuum you use to pull the material over the plug. Another basic requirement is that the plug must be tapered upward, i.e., be wider at the bottom and narrower at the top so that it can be removed after the canopy has been formed. Slight

blisters, such as those on the rear of the Ju 87 and Fieseler Storch and the bulged sides of later Spitfires, are OK, but don't expect to make a scale Mosquito bomber canopy out of one piece of plastic; additional smaller parts will be required here. In multipiece plugs, adding an extra 1/2 inch or so to the front and rear of each plug to form tapers will also make them easier to remove.

Be sure to remove all dust from your plug, as even a speck will immediately be visible in the formed canopy. If any sharp edges must be reproduced, drill small holes (about 1/32 inch in diameter) along the edges to allow air to escape and the canopy to pull down completely in those areas. Once you have pulled the canopy, let it cool for a while before you



For a "one-off" canopy, make your plug out of all balsa. Use a good side-view drawing, and start with the profile.



Keep adding balsa, and work the shape of the plug until it is as accurate as you can make it. Here, the rough plug is ready for shaping and sanding.

remove it from the plug. If you remove it too soon, it may be deformed.

Don't be surprised if you have to form two or three canopies before you get the knack of using the correct amount of heat and vacuum to form a usable canopy. Like anything else worth doing, it takes practice.



For more durability, make your canopy using a mold. Covering the wooden plug with cloth and epoxy is the first step toward a perfectly finished plug.

For those who want to make one good-quality canopy but have no intention of making a competition-class model, using a balsa plug will work just fine. Be sure to use wood of equal density throughout its construction, and don't use plywood for cores or formers. Use glue that is easy to sand, and then give the plug a final pass with dry, 400-grit sandpaper. Don't be tempted to apply dope, epoxy, or anything else to fill the wood; bare wood will be just fine.

MORE THAN ONE

If you wish to produce multiple canopies, you'll proceed differently. For better results, commercial canopy makers use the original plug only to make a basic negative (female) mold in which a second production plug is made. After I have made the first plug, I cover it with resin and thin glass cloth. I then prime it several times to produce a good, smooth finish. Don't go crazy on the sanding; final-sanding with wet, 400-grit paper will be fine. No further treatment, such as polishing, is required. Don't be tempted to make a canopy from this plug; it will not work because of the materials used.

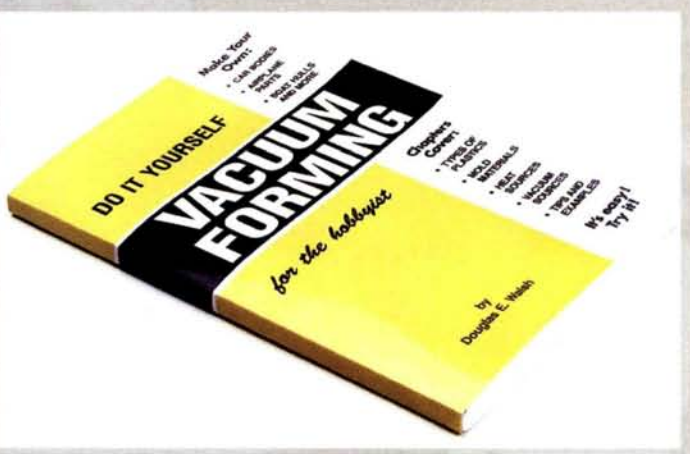
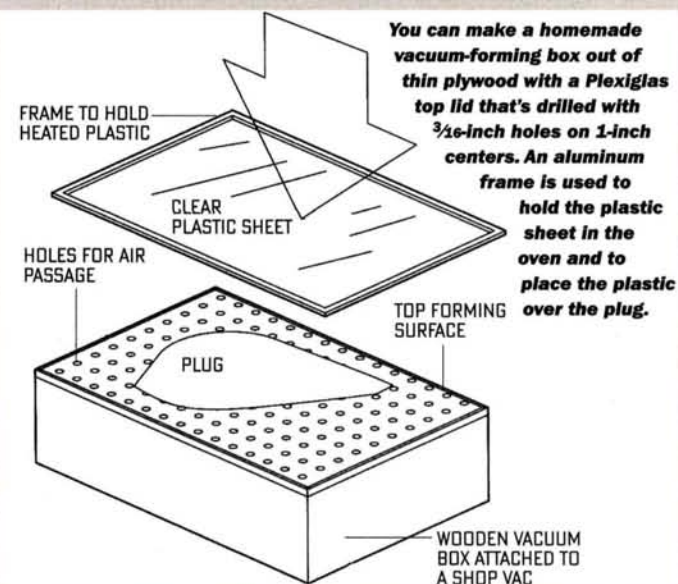
When you've finished making the first plug, use it to make a



The finished plug is ready for vacuum-forming the canopy or for making a female mold for producing a production plug.

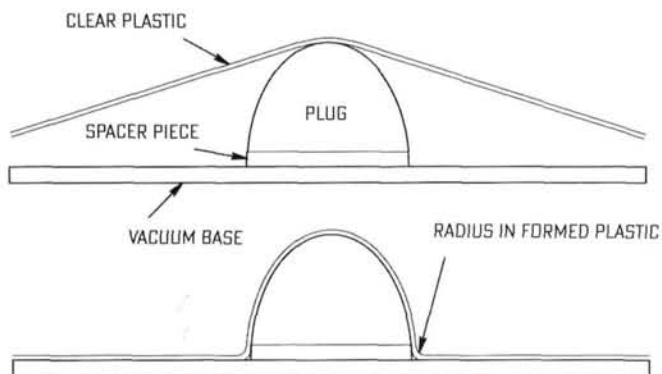
DO-IT-YOURSELF VACUUM-FORMING

A good source of information for hobby-related forming is Douglas E. Walsh's book "Do it Yourself Vacuum Forming for the Hobbyist," published by Vacuum Form. Complete with illustrations and photos, it includes instructions on building your own vacuum-forming machine as well as sources for various plastic-sheet materials. Contact Vacuum Form, 272 Morganhill Dr., Lake Orion, MI 48360; (248) 391-2974.



female mold. It is required for only one item—the production plug. The recipe for making a final plug is pretty much the same as the one for making a fiberglass part. After treating the inside of the mold with a release agent, I use a minimum of three layers of molding compound. This is brushed on after it has spent a few minutes in a vacuum chamber to remove any trapped air bubbles. Don't confuse molding compound with gelcoat; it's an entirely different product.

After the molding compound has cured to the "sticky" stage, I apply a mixture of milled fiberglass fibers, chopped strands and resin to the compound in an 1/8-inch-thick layer and allow it to stiffen. The purpose of this layer is not to flatten the wrinkles but to reinforce the resin without a weave. If you use a cloth, it will show through, no matter how well you sand it. Next, I make a mixture of dry, fine sand and resin and, wearing rubber gloves, I put it into the molding. The resin-to-sand ratio is about 10 percent by weight, which gives the sand just enough adhesion to stick together. This sand/epoxy mixture needs to be about 3/4 to 1 inch thick to be able to withstand the forces acting on the plug during the vacuum-forming process. When this is all done and the resin gets to the gel



The plug you mold your canopy over has to be wider at the bottom than the top so it can be removed after the plastic has been formed around it. Adding a spacer piece to lift the plug up off the vacuum base helps prevent the radius in the formed plastic from distorting the shape of the finished canopy.

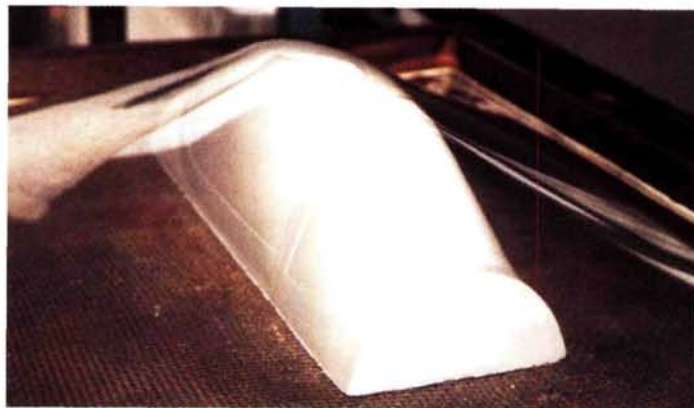
stage, I pour fresh resin around the perimeter of the plug. The resin tends to be absorbed by the sand, and this can lead to brittle edges; you can prevent this by applying resin liberally around the perimeter at the end of the process. Then I remove the final plug from the mold and sand it carefully with wet 400-grit paper. It is from this production plug that hundreds of canopies can be formed.



Depending on how many canopies you intend to make, you can use commercial vacuum-forming machines, or you can have a professional company do the job for you. Here, the plug is in place in the vacuum-forming machine.

MATERIALS FOR VACUUM FORMING

The variety of suitable materials ranges widely in quality and price. Polyvinyl chloride (PVC) is one of the most commonly used materials; it's inexpensive and easy to stretch but not very transparent. It has a blue shine and becomes white or yellow when it's subjected to ultraviolet rays for a long time. Polyester sheet is preferable to PVC because it's highly transparent, but it has one major drawback; it is very statically loaded and attracts dust easily. Although it's less expensive than PVC, it also tends to yellow after long exposure to sunlight. Nowadays, "coated" versions of these materials are available, but they're a bit pricey.



As the air is removed, the heated plastic is pulled down over the plug.

As canopies don't add any strength to the airframe, you should make them as thin as possible. An average thickness of $\frac{1}{64}$ to $\frac{1}{32}$ inch is usually more than sufficient. As a rule, canopies that are 4 to 6 inches long should be made out of $\frac{1}{64}$ -inch-thick plastic, and larger canopies (no more than 12 inches long) should be made of $\frac{1}{32}$ -inch-thick plastic. Anything larger should be made out of $\frac{1}{16}$ -inch-thick plastic.



Here, the vacuum-forming process is complete. After the plastic cools a bit, the plug can be removed.

HOMEMADE OR STORE-BOUGHT?

OK, it's decision-making time: do you want to create your own canopy-forming machine (box), or do you want to obtain the services of a professional? If you choose the latter, begin by looking in the plastics or packaging businesses sections of your phone book or online. Using a professional to produce your canopy might cost you a few bucks, but the results will fully justify the expense. You cannot, however, beat the satisfaction gained from building your own plug that is suitable for producing commercial-quality canopies. It

takes a bit of time, but the results will be worth it. Have a go at it, and you will find that making your own canopies is a great addition to your model-building skills. ✦



The formed canopy has just been removed from the plug. During the forming process, make sure that the plug is dust-free; even a speck will be noticeable on the formed canopy.



MODEL MODELS BY RICK BELL Focke-Wulf

I'm a big fan of warbirds, and one of my all-time favorites is the WW II German Focke-Wulf Fw 190. It's widely regarded as Germany's best fighter and ranks with the F4U Corsair, P-51 Mustang and Spitfire as the best of the best. It was so good that you can trace the origins of the Hawker Sea Fury and the Grumman Bearcat back to the Fw 190.

FW-190

A precision modeled warbird with performance

Hobby Lobby has really embraced electric-powered airplanes, so it has a great selection of warbird models from which to choose. Noticeably lacking, though, was a German fighter—until now. Hobby Lobby recently added the spectacular Alfa FW-190 to its lineup. This all-foam fighter requires a minimum of effort to be sortie-ready and gives new meaning to the phrase “almost ready to fly.”

IN THE BOX

The airframe of the Alfa FW-190 is completely assembled and painted in an authentic camouflage paint scheme (how's that for convenience!). It consists of only two parts: the complete fuselage assembly and the wing. The cowl, canopy, control surfaces, pushrods, control horns, firewall and servo tray are installed to save you a ton of work. Great-looking water-slide decals (for two versions of the FW-190) round off the package.

Because the model is made of foam, hard plastic covers the foam where most of the abuse is likely to occur. The underside of the fuselage and the leading edge of the wing are just two of the areas that are reinforced. The wing is removable, and the model fits nicely in its box for transportation and storage. Access to the radio equipment is through a hatch in front of the canopy; a cleverly designed latch holds it securely.

The model spans 33.5 inches, is 28.75 inches long and sports 186 square inches of wing area. If the target weight of 16 ounces (or less) is adhered to, the model's wing loading will be a little more than 12 ounces per square foot, and performance will be very scale. Mine weighed just under 16 ounces ready to fly. To make the fighter mission-ready, you'll need 2 microservos and a receiver, a geared Speed 300 motor, a 14A ESC and an 8-cell, 1100mAh NiMH battery pack. I've pretty much switched to using brushless motors and Li-poly batteries in all of my models. I chose the new MP Jet Outrunner motor, 2- and 3-cell Kokam 1500mAh Li-poly batteries and a Jeti Advance 18A ESC.

The electronics included a Hitec Micro 555 receiver and 3 HS-55 Feather servos. You might have noticed that I have an extra servo onboard. A lot of park flyers don't use a rudder (which I really miss when flying), so to gain more control, I decided to add a functional rudder at the expense of a little weight. To fine-tune the model's performance, I tried several APC electric props to optimize the current draw with the use of an AstroFlight Whattmeter.

ASSEMBLY

Making the Alfa FW-190 flight-ready is a simple exercise and takes very little effort. If I hadn't added a working rudder to the model, I could have been out flying it in about 2 hours. The most time-consuming assembly task is applying the water-slide decals; they're very delicate. The instruc-



I used an MP Jet Outrunner motor with radial mount, a Jeti Advance brushless ESC and a Kokam Li-poly battery to power the model.



I made pockets and recessed the magnets at 12 & 6 o'clock; a couple of drops of epoxy holds them in place. Mating washers are glued inside the cowl.



I used RadioShack rare-earth magnets to attach the cowl to the fuselage; they only cost a couple of bucks.

tions are loosely translated from Czech, but the model goes together so easily that the instructions are primarily a guide.

I installed the motor first; there are three indents for the motor mount on the firewall. To use the MP Jet Outrunner motor, the radial mount must be installed “backward” on it. This places the motor closer to the firewall and allows the cowl and spinner to fit properly. The cowl fits very nicely on the fuselage, and the instructions recommend that it be tack-glued into place. Instead, I

by the numbers

When using Li-poly batteries, you must make sure that you don't draw more current from them than they are capable of providing. If you do, you'll quickly ruin them. The prop size determines the load placed on the battery and the watts produced, so you should balance the two for the best performance without overloading the battery. The batteries I used can be discharged at 12 amps with surges up to 15 amps. I flew the model with various APC props, and shown below are the performance numbers of the power system with a 1500mAh 2- and 3-cell Kokam Li-poly battery pack. I used an AstroFlight Whattmeter to obtain the figures.

(The best choice in each category is shown in yellow.)

	Prop size	Draw (amps)	Watts	Volts
Kokam 2-cell	9x6	11.5	75	6.2
	9x4.5	7.6	54	6.8
	8x6	8	55	6.8
	8x4	6.2	44	7.1
Kokam 3-cell	9x6	17	153	8.6
	9x4.5	12.5	122	9.6
	8x6	12.4	119	9.4
	8x4	10.1	106	10

As you can see, the 9x6 prop on 3 cells produces the most watts, but it places the greatest load on the battery, which in this case is too much. For the 3-cell pack, the 8x4 prop worked well, and the best prop on 2-cell was the 9x6.

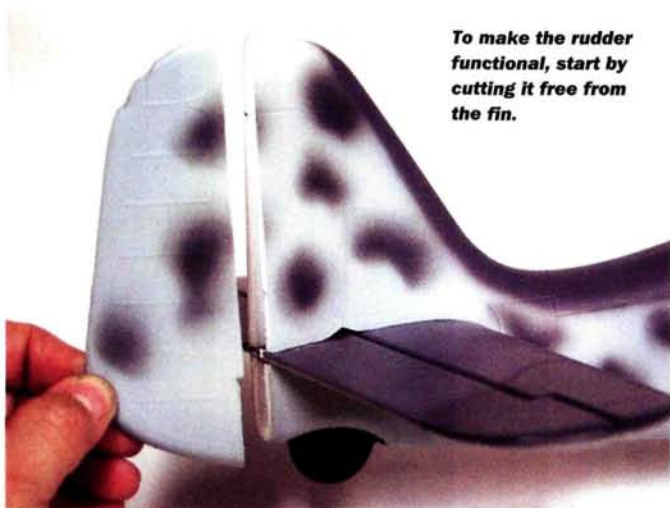
recessed and glued a couple of rare-earth magnets (that I bought from RadioShack) at 12 and 6 o'clock on the nose of the fuselage. I then glued thin washers in matching positions inside the cowl. The magnets are very strong and hold the cowl very securely.

The aileron servo is installed in the center of the wing, and the factory-installed pushrods are easily connected to the servo. Installing the elevator servo is just as easy, but be sure to glue the pushrod sleeve to the support. The instructions direct you to install the receiver and ESC next, but I waited to install them until after I had added the functional rudder.

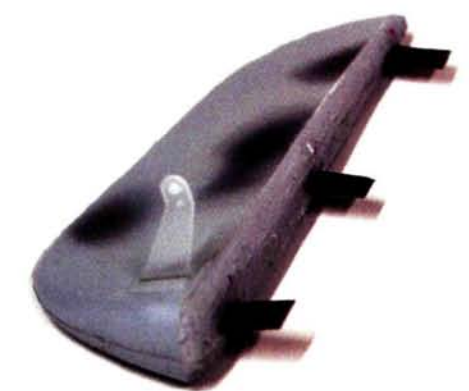
RUDDER MODIFICATIONS

Making the rudder functional required a minimum of effort and materials. Hobby Lobby has guidelines on its website for this conversion, and they work well. The first step is to cut the rudder free; I used a new no. 11 hobby-knife blade and a metal ruler to make the cut. The rudder and fin are hollow, and the trailing edge of the fin and leading edge of the rudder must be filled so the hinges have something to grip. I used a couple of pieces of pink insulation foam. It took only a couple of minutes to shape the

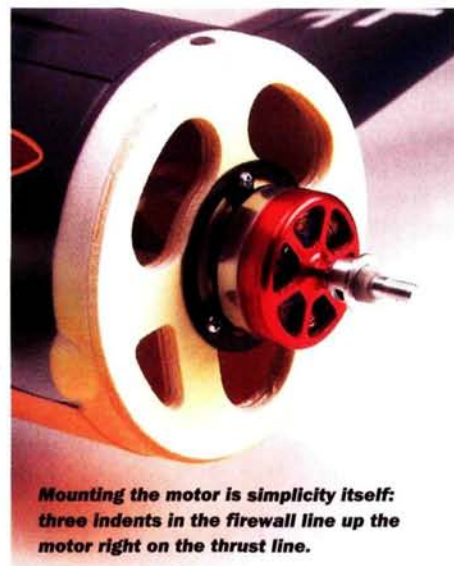
To make the rudder functional, start by cutting it free from the fin.



I shaped a small piece of pink insulation foam to fill the leading edge of the rudder. Do the same on the trailing edge of the fin.



Above: an old floppy disc makes great hinges for park flyers. A little epoxy securely holds the hinges. Note the GWS control horn. Right: after rounding the leading edge of the rudder, I sanded a matching concave in the fin.



Mounting the motor is simplicity itself: three indents in the firewall line up the motor right on the thrust line.

foam and then glue it in with epoxy. When the epoxy had cured, I rounded the leading edge of the rudder and sanded a matching concave in the trailing edge of the fin. I touched up the bare foam with gray acrylic paint. I cut hinges out of an old floppy disc and used epoxy to secure them. The rudder control horn was an extra GWS horn that I had lying around.

The servo tray has a cutout for the rudder servo, and an extra pushrod support is in the kit. Using the "That looks about right" method, I made a pushrod exit in the fuselage and snaked the outer sleeve from a Du-Bro micro pushrod (item no. 847) to the pushrod support. I installed the rudder servo and hooked up the pushrod to it, and the conversion was complete. Total time for this modification was about 1 hour.

With the servos in place, I added the receiver, ESC and battery. I used Velcro® to mount the receiver as far back in the fuselage as possible and the ESC on the side of the fuselage above the elevator servo. The rudder servo took up the space where the

battery needed to be to balance the model, so I made a cradle for it out of 1/32-inch sheet balsa and placed it on its edge between the servos. I applied the decals, and the Focke-Wulf was ready for its first mission.

FLIGHT REPORT

This fighter rocks! I had senior tech editor Gerry Yarrish hand-launch the plane for its first flight, and from the moment it left his hand, I knew I had a winner. The little FW-190 feels like a much bigger plane in flight and grooves like a pattern ship. With the 8x6 prop and the 3-cell battery pack, top speed is around 55 to 60mph. In true warbird fashion, the little fighter will perform any maneuver asked of it. Adding the rudder was a definite plus, as I could hold the model in a knife-edge attitude and it would do killer rolls. Strafing runs on the deck are just too cool!

BUILDER'S FINAL THOUGHTS

This is the first Alfa warbird that I've had a chance to fly, and it certainly won't be the

last. The model assembles quickly without effort and flies better than it looks. The MP Jet Outrunner motor and Li-poly battery create a winning combination that will provide many hours of dogfighting thrills. Try one, and don't forget to "check your six"! ✈

Alfa Models; distributed by Hobby Lobby.

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Du-Bro (800) 848-9411; dubro.com.

FMA (800) 343-2934; (301) 668-4280; fmadirect.com.

GWS USA (909) 594-4979; gws.com.tw.

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**SEE THIS
WARBIRD IN
ACTION!**

AT MODEL AIRPLANE NEWS, we not only tell you what's new, but we also try it out first so we can bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."

SKY & TECHNOLOGY

Basic Tool Set

Do the job right

It's easy to take hand tools for granted. Screw, hex and ball drivers are a necessity for any RC project, but when is the last time you thought about yours—except when you couldn't find them? Well, just because they are ubiquitous doesn't mean they are all created equal; a good set can make you appreciate the most basic tool as if it had just been invented. Sky & Technology's Basic Tool Set consists of 10 drivers: 4 and 6mm slotted screwdrivers, 4 and 6mm Phillips screwdrivers, 2 and 2.5mm ball drivers and 1.5, 2, 2.5 and 3mm hex drivers. These are the most common sizes and designs for RC use. That they're available in one set is great, but what's really impressive about these tools are the little extras.

Each tool has an anodized-aluminum handle that is engraved with the size and tip type for easy identification. Each handle is amazingly light and features checker-pattern bands for a secure grip. They fall comfortably in hand, and the checker grips sit right where your hand naturally applies torque. Each handle is affixed to the shaft with a setscrew for easy replacement—not that you'll ever need to replace them; the High Speed Steel shafts and tips are strong enough for pretty much any hobby application. They were designed using a 3D CAD program, so the fit of the tips is ultra precise. Try finding that with the drivers from your hardware store's bargain bin. I can't imagine you'd ever strip out screws with them—if you use them properly. For added convenience, each handle has four 90-degree



hash marks for keeping track of rotations during precise adjustments. I also like that each handle has holes drilled perpendicular to the shaft near the top. You can easily pass the shaft of another driver through these holes to use as a cross-handle for additional torque.

I found the Sky & Technology drivers well suited to my hand and pleasant to use. The checker grips work, and the tips are so exact that they click home as you engage a screw. Those two tactile impressions and the sharp-looking anodized handles are well worth the \$75 asking price.

—Matt Boyd

Sky & Technology (310) 527-0002; sky-technology.net.

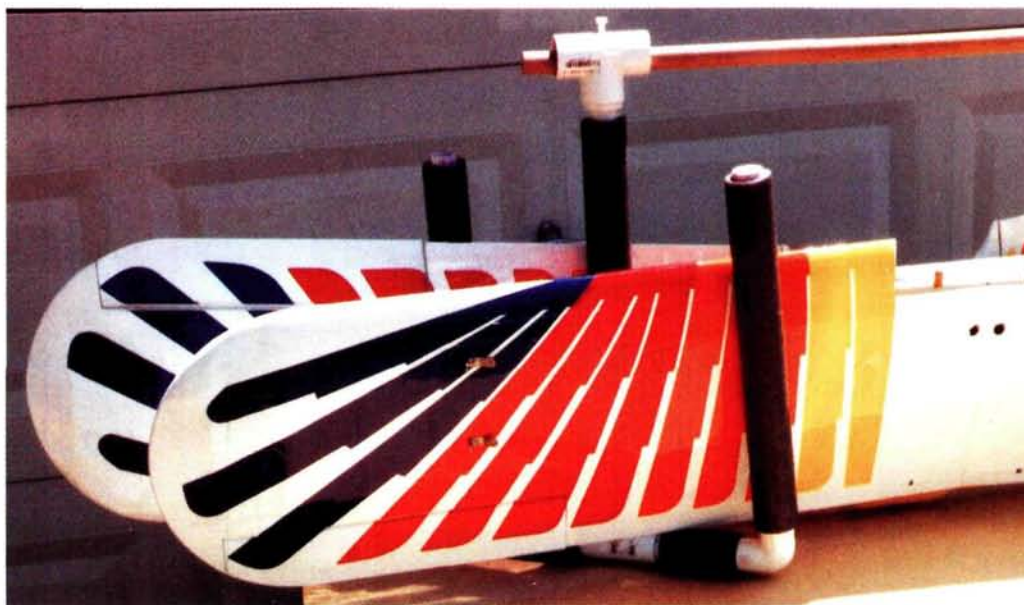
AVIATION CONCEPTS

Adjustable Wing Caddy

The Adjustable Wing Caddy makes it easier to store and transport your plane's 1/4-scale wings. Made out of PVC pipe and pipe padding, the caddy is fully adjustable for a maximum wing thickness of 4½ inches and a minimum wing length of 30 inches. You can transport the wing with it standing up or lying down, but if you stand it up, be sure to brace each side.

This precut kit comes with all the fittings and hardware needed for assembly; you just have to supply the inexpensive PVC cement. A very detailed 5-page manual with photos guides you through the entire construction assembly. Your wing tube (up to a maximum of 13/16 inch) or a wooden dowel can be used as the handle.

This is a safe way to transport large wings to and from the flying field while protecting and preventing damage to the wings. Assembling



the kit takes about an hour, and at a street price of \$39.95, it is well worth the investment.—Robert Reid

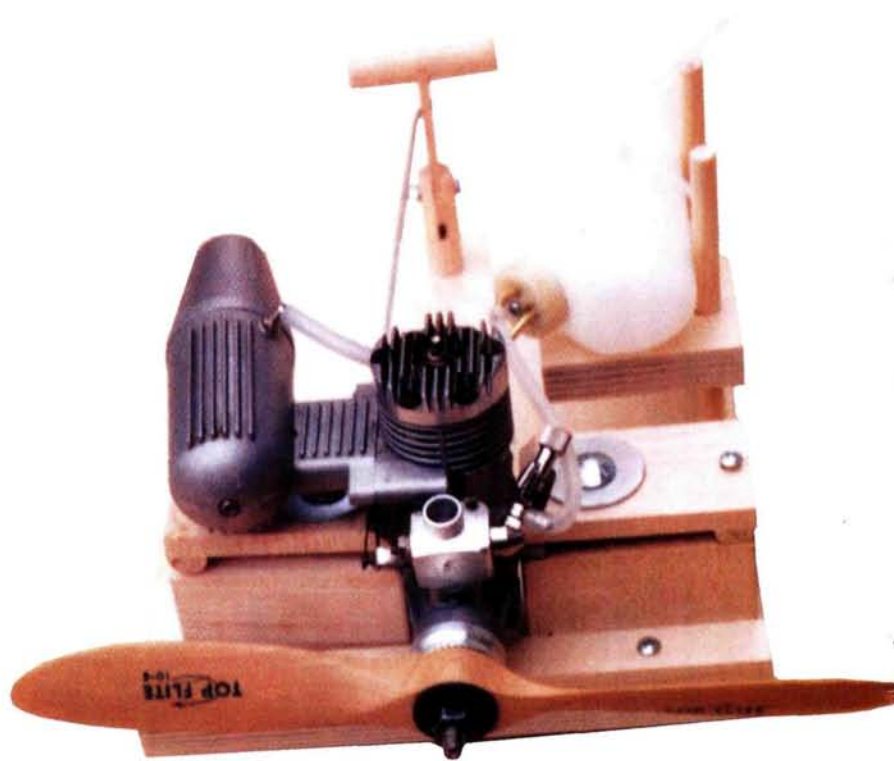
Aviation Concepts; distributed by Hangtimes Hobbies (631) 610-5169; hangtimes.com.

AMERICAN HOBBY PRODUCTS Millennium Series MK-2 Break-in made easy

We all know that the best way to break in an engine is to run it on an engine stand, so we can control the amount of fuel and run time and monitor the engine temperature. This is extremely critical, as it's hard to do with the engine mounted inside a cowl or with the plane in flight. No one knows this better than American Hobby Products. Its new Millennium Series MK-2 deluxe test/run-up stand provides a safe and secure solution for running your engine.

Made of fine-quality birch and maple, this new stand has many features. The engine clamps are spring loaded and made of solid maple, as are the engine mounts. The tank table and the large 7 $\frac{1}{2}$ x9 $\frac{3}{8}$ x $\frac{5}{8}$ -inch base are made of thick plywood birch. The height of the tank table and the included tank can be adjusted so you can keep the tank's centerline even with the carburetor regardless of the size of the engine you're running. An adjustable nylon hold-down strap maintains a firm grip on the tank and prevents it from vibrating off the mount. The included T-toggle throttle and pushrod let you set the throttle at all levels from idle to full.

This stand will hold engines from .10 to .90 size. A detailed instruction manual with construction photos is included in the box. The manufacturer recommends that you fuelproof it with clearcoat (I suggest that you add three coats). After you've applied the finish, it takes



only about an hour to assemble. Considering that it can extend the useful life of an expensive glow engine, this stand is a steal at \$34.95.—Robert Reid

American Hobby Products (781) 944-8316.

SLIMLINE M4 Fuel it up!

Leave it to Slimline to devise a way to get fuel from the bottle to the airplane's tank with the greatest of ease. Its new M4 manual fueling system does just that; it provides a solid seal to keep the fuel fresh and allows quick and easy fueling of your favorite planes. This new fueling system builds on Slimline's Pro Cap 360, which is constructed out of CNC-machined aluminum and made to withstand rough treatment. The entire system includes a manual pump, Pro Cap 360, fill nozzle, glow O-ring, mounting hardware and silicone fuel tubing.

The Pro Cap 360 fits any standard 1-gallon fuel bottle and allows you to position the fuel nozzle receptacle to best suit your needs. The fill nozzle locks firmly into the cap and prevents spills and any air from getting inside. The nozzle can be used with any of Slimline's F1 or Excel brand fueler systems. Mounted to the cap is a good-quality, self-priming fuel pump. The system is self-contained and easy to transport, so fueling your plane is simple. After I used this manual fueling system, I never used an electric pump again. You have complete control over the flow and speed at which you fill the tank. If the tank starts to overflow, you can instantly reverse the fuel flow. I now have the F1 fueling system on almost all of my planes, and



I can fill many planes in minutes. At a price of just \$39.99, you'll wonder how you ever got along without this product.—John Reid
Slimline Mfg. (480) 967-5053; slimlineproducts.com. ⬆



Classic Model Airplane News *by Matt Boyd*



... Jo Kotula's rendition of a Douglas A4D Skyhawk on the October 1954 cover marked the successful flight of the first prototype of that aircraft that occurred earlier in the year. In the decades since, the A4D has posted the longest tour

50 years ago ...

of duty of any combat aircraft in the U.S. arsenal—one year longer than that of the venerable B-52! The A4D remained an active combat craft until the mid-'90s, and it still serves

as a target tower and adversary craft for combat simulations.

... contributor Les McBrayer showed readers how to build the Scrambler—a sleek little team racer. With a span of just 27 inches and powered by a K&B .29, it promised lots of performance. It was also convenient; its completely modular "take-apart" construction made it easy to experiment with alternate airfoil and tail designs, simple to service and a snap to transport.

... we showed off what might be considered a precursor to the modern microflyer: Bill Dean's Skyray. Powered by a Jetex rocket motor, this tiny profile jet had an asbestos strip that prevented the balsa from being scorched by the solid-fuel motor.

... the Concept Fleet giant-scale biplane dominated its runway overlooking a beautiful Hawaiian backdrop in what might be our most scenic "Field and Bench" review ever. Al Tuttle powered this big beauty with an E.W.H. Super Hustler, a Homelite-based gas engine that had enough grunt to spin the recommended 20x8 prop at 7,000rpm.

... Harry Higley showed us the tricks of crafting a competition-worthy smoke system. From running oil and pressure lines and installing crankcase fittings to setting up the valve mechanism, the principles Harry employed in 1979 still work today.

... the Sportster 20 showed that a well-engineered model can fill an amazing variety of roles. The Dick Sarpolus design acted like a trainer when flown gently, but it could produce pattern aerobatic performance when the sticks were worked a little.

25 years ago ...



... the cover story of the October 1994 issue declared (in hot pink, even!) exactly what excites so many people about pylon racing: the sheer speed. At that year's Galveston Unlimited Races, the double-century barrier was left behind to flutter in the Gulf Coast breeze as the purpose-built giants powered their way to speed and glory.

... Clark Smiley demonstrated a handy technique for turning WWI wheels on your drill press. The process required very basic materials and surprisingly little build time, and the final results gave an impressive scale look. ... electric flight guru Tom Hunt gave us an inside look at the performance potential of AstroFlight's powerful FAI 25-5T and 40-5T motors. With awesome thrust capability and impressive efficiencies, these were the hot setups for FAI sailplane events. Of course, brushless motors have since made this level of performance more attainable, but at the time, these were two electric powerplants to beat. ✚



10 years ago ...

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WANTED: R/C Flight Instruction in North Central Georgia Mountains "Blairsville." (705) 745-8667. [8/05]

MAGAZINE BACK ISSUES: MAN, RCM, FM, model and full-scale titles, 1930-2003. Send SASE for list: Carolyn Gierke, 1276 Ransom, Lancaster, NY 14086. [11/04]



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The "Marvelous Mitchell"

SoCal modeler's B-25J beauty

At any scale event, there is always one aircraft that stands out from the rest.

Such was the case at the recent Scale Squadron of Southern California's 2004 Western Regional Scale Masters Qualifier. The B-25J Mitchell built by Jimmy Mazurek of Oceanside, CA, attracted a crowd of admirers throughout the day—and for good reason. This finely detailed scale warbird took form from raw materials and a set of Nick Ziroli plans. After two years of construction, Jimmy revealed his masterpiece in August 2002.

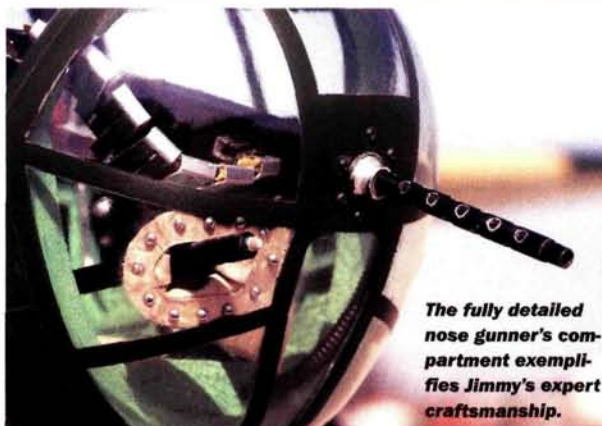
This large model has a wingspan of 101 inches, is 79 inches long and weighs 37 pounds dry. After the plane has been fueled up with 32 ounces of gas for each motor and 10 ounces of smoke fuel, the total takeoff weight is just under 42 pounds. Part of that weight comes from all of the extra items used to detail the visible interior, including a superbly done cockpit with two pilots, a richly detailed nose gun, top turret, tail gun and wing guns. Two 1.80 Saito 4-stroke engines provide more than enough power to lift this bird into the sky.

Constructing a scale plane that's this detailed requires enormous patience and ingenuity. The plane has a good complement of standard modeling items such as Du-Bro hardware, Robart gears, Graupner 3-blade props, an Airtronics flight pack and an Airtronics PCM Vision radio. Other items, however, required a scavenger

The B-25J makes a slow flyby streaming smoke—a realistic depiction of wartime flak damage.



The B-25J sitting on the tarmac. Looks like the real thing, doesn't it?



The fully detailed nose gunner's compartment exemplifies Jimmy's expert craftsmanship.

hunt to locate! For example, the upper turret-gun shields require just the right arc and concave surface to fit within the opening of the turret. Jimmy found that the bottom of a beer can has just the right concave surface, and after numerous experiments (requiring him, of

course, to finish off the beer inside each can), he found that a large can of Foster's fit the turret gun's opening perfectly.

The B-25J has a plethora of scale details to keep the static judges busy, but it doesn't stop there because once the B-25J is airborne, it has plenty of extra features to show off. Curtis Kitteringham pilots the plane for Jimmy, and he knows how to use these extra features to maximize their scale performance. He takes off with a nice, straight run down the centerline of the runway. Once the plane begins its ascent, he flips a switch, and the gears fold into the belly followed slowly by the gear doors. During a mock bombing pass, Curtis activates the B-25J smoke system and, because it is hooked up to only one of the engines, it very realistically simulates flak damage. As the B-25J approaches the target, the bomb-bay doors open slowly, and when the plane is directly above the drop point, he releases two 1,000-pound bombs. Last, when the plane sets up for landing, Curtis lowers the flaps, drops the gears and flicks on the landing lights.

After a nice, gentle touchdown, the B-25J taxis over to the pit area;

a crowd gathers, and before you know it, camera shutters are clicking and spectators are asking questions. Jimmy Mazurek beams with pride and answers every question. This is what scale competition is all about: a master sharing his knowledge with his apprentices. ✦